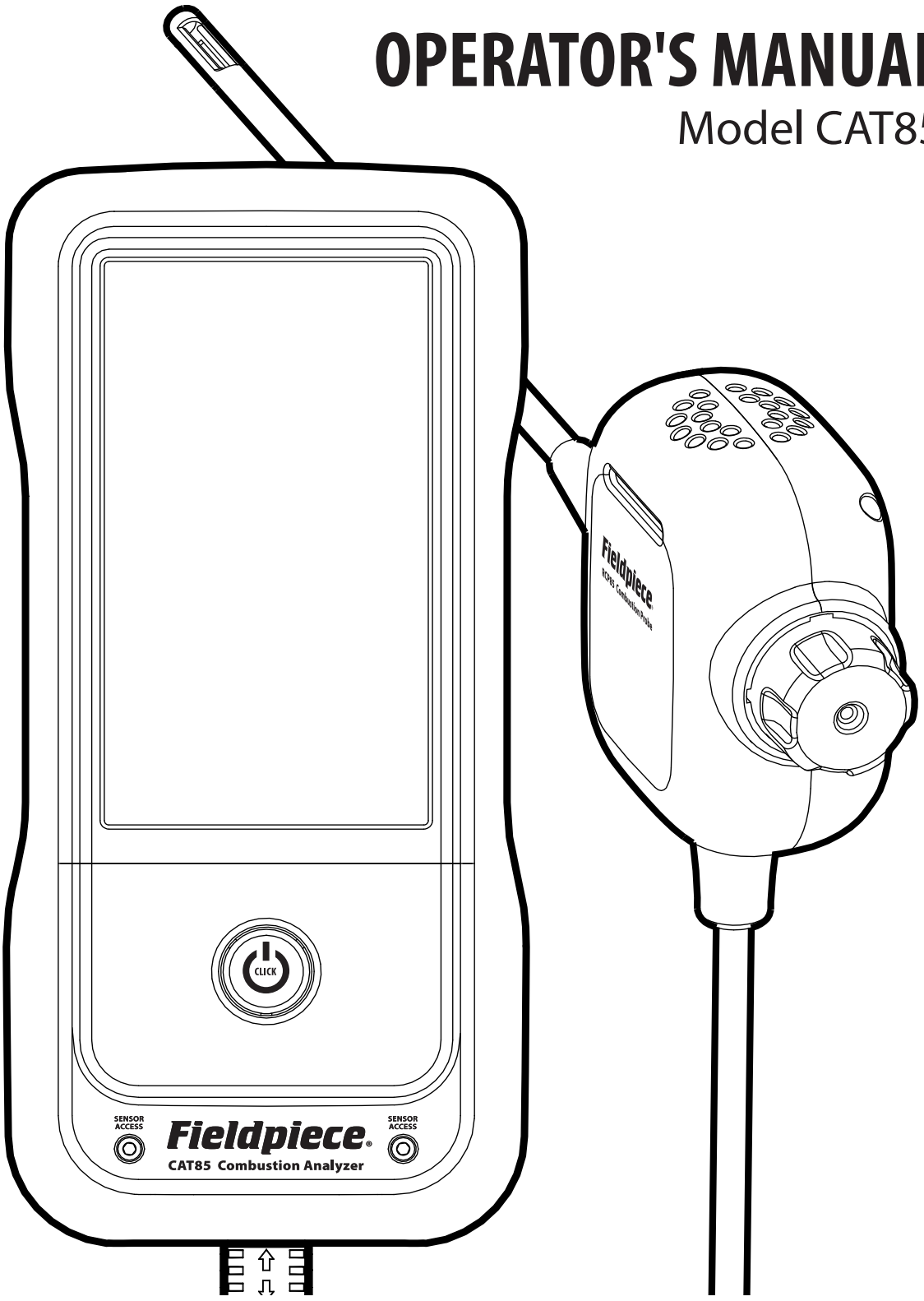
Fieldpiece®

Combustion Analyzer HC

OPERATOR'S MANUAL

Model CAT85



Contents

Safety Information

Only qualified personnel trained in service and installation of electric heaters, boilers, and furnaces shall use this combustion analyzer.

This device measures and analyzes key parameters of combustion equipment including oxygen, carbon monoxide, temperature, carbon dioxide, efficiency, and draft pressure.

Read and understand this operator's manual in its entirety before using to prevent injury or damage to you or the equipment. As with any job, appropriate use of personal protective equipment (PPE) is required.

⚠ WARNING

- Do not use the analyzer as a safety device.
- Always be aware of and test for ambient CO levels.
- Do not use unless in a well-ventilated location.
- Do not use in areas classified as hazardous locations; not intrinsically safe.
- Do not use unless a visual inspection ensures it's safe to do so.
- Ensure any connections to fuel sources are leak-free.
- Do not touch or store probe until it cools to ambient temperature.
- Condensate may be acidic.
- Combustion gases may be toxic even in low concentrations.
- Seal any equipment holes used during testing in order to prevent dangerous flue gas entering the space.

⚠ CAUTION

- Do not use or store near solvents.
- Do not clean with solvents.
- Do not use on a continuous basis.
- Refer to 3rd party smoke test documentation to verify if smoke in equipment is at a safe level (1 or less). Not verifying this prior to conducting other tests, such as combustion, can result in damage of the analyzer and produce incorrect measurements.
- This device should only be opened and/or serviced by authorized personnel. Gas sensors may be replaced by user.
- Do not apply pressures above maximum specifications.
- Do not disconnect combustion probe cable when powered on.
- Use only within operating environment specification.
- Do not use in the rain or wet environments.

Description

The Fieldpiece CAT85 Combustion Analyzer HC provides a hassle-free solution for technicians to get the job done quickly, easily, and safely while improving system efficiency.

Accurate sensors of O2, CO, pressure, and temperature along with powerful trending, provide key insight into equipment performance. SensorVault™ technology seals to prolong sensor life.

Live draft pressure measurement maintains accuracy throughout your combustion test. Dual manometer ports measure fuel pressures and static pressures. Manometer hoses are included with brass fittings for convenience.

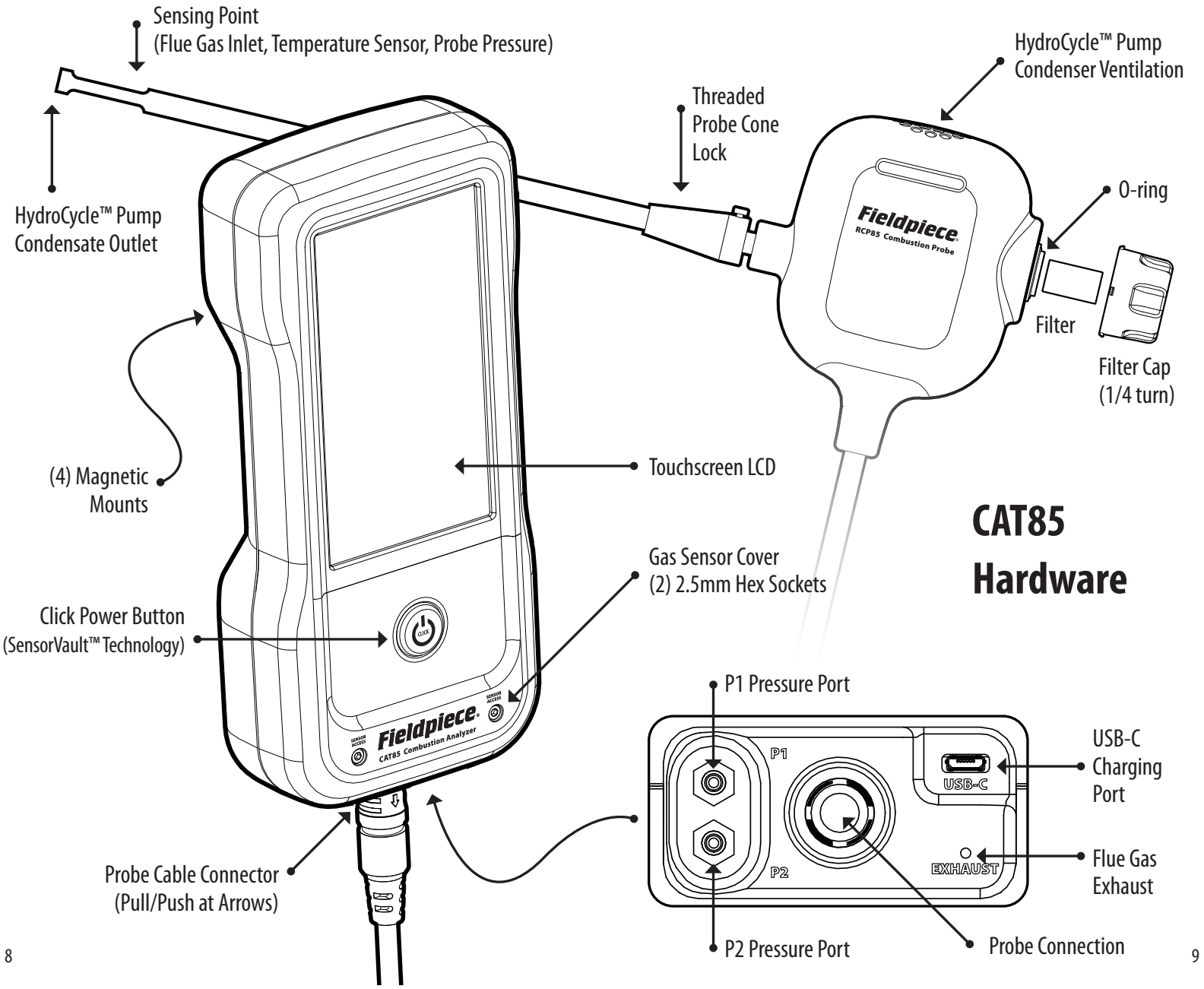
The combustion probe uses a patent pending HydroCycle™ pump to return condensate back into the flue - no more water trap hassles!

Features

- 4 Year Gas Sensor Warranty
- Large Intuitive Touchscreen
- Powerful Trending
- SensorVault™ Technology
- HydroCycle™ Pump
- Real-time Live Draft Pressure
- Dual Manometer Ports + Hoses
- Rechargeable Battery
- In-use USB-C Charging
- Field Replaceable Smart Sensors
- Job Link® System App Compatible
- Wireless Printer (CATPR) Compatible
- Durable Hard Lined Case

What's Included

- Combustion Analyzer
- Combustion Probe + HydroCycle™ Pump
- 2 Manometer Hoses + Brass Fittings
- Hard Lined Carrying Case
- Extra Dust Filters and O-rings
- USB-C Charging Cable
- Operator's Manual
- 1 Year Device Warranty
- 4 Year Sensor Warranty



CAT85 Hardware

Operation

The CAT85 workflow is streamlined to quickly get into your job, complete your testing, send your report, and get onto your next job.

SensorVault™ Technology

SensorVault™ technology mitigates the typical degradation of electrochemical sensors by placing a gas-tight cover over the gas sensors when the analyzer is powered off which seals the sensors in storage.

This sealing and unsealing is done with the power button, so be sure to press far enough down to hear and feel the "click" of the seal.

HydroCycle™ Pump

The HydroCycle™ pump eliminates the need for a traditional water trap. Flue gas is drawn into the CAT85 probe and passes through a cooling chamber where condensate is captured and periodically pumped back through the probe tube into the flue. Point the probe downwards as you remove it to empty any remaining condensate before storing.

Battery Life and Charging

CAT85 can be operated while charging its battery so it's a good idea to store a charger and cable with the analyzer.

Charge with a USB-C to USB-A cable connected to a 5V/2A DC charger/port/adapter. *High speed chargers are not supported.*

To maximize battery life, you can disable the Job Link® system, lower display brightness, disable button sounds, and stop the pump when it's not needed. Battery life may be reduced when testing equipment hot enough to trigger the enhanced cooling mode of the HydroCycle™ pump.

It's possible CAT85 may power on automatically when plugged in to charge. This occurs if the battery had depleted and powered off without pressing the power button, leaving the sensors unsealed. Fully press the power button down to seal the sensors, power off, and continue charging.

Powering ON

Read "Safety Information" section.

1. Push the probe cable connector into the bottom of CAT85.
2. Move probe to fresh ambient air for accurate sensor zeroing.
- *This step should be executed outside of the test room and away from any vehicle exhaust where traces of CO could be lingering.*
- *Do not rely on the analyzer alone to check for unsafe CO levels.*
3. Fully press the power button down until you feel and hear the "click" of the SensorVault™ technology UNSEAL the sensors.
- *Press deeper if it displays "SEALED".*
4. Wait for start countdown to complete.
5. Start testing. *See "Job Menu" section.*
- *Electrochemical gas sensors require extra time to stabilize if sealed for an extended period of time or sealed shortly after being over-exposed to target gases. In these cases, you may see an unusually high CO or oxygen reading. To prepare the sensors for testing, start a COMBUSTION test in fresh air until the CO reading returns to 0 and oxygen reading is stable (typically less than half an hour), then ZERO PROBE to 20.9% O2.*

Allow ON/OFF countdowns to complete. Interrupting requires pressing the power button a third time to UNSEAL/SEAL the sensors and restart the countdown.

Powering OFF

Read "Safety Information" section.

1. Complete your testing and reporting.
2. Move probe to fresh ambient air to clear CAT85 of hot flue gas.
3. Fully press the power button down until you feel and hear the "click" of the SensorVault™ technology seal the sensors.
- *The unit powers off when SEALED and purging is complete.*
- *Press deeper if it displays "UNSEALED."*
4. Store safely. *See "Storage" section below.*

Storage

Read "Safety Information" section.

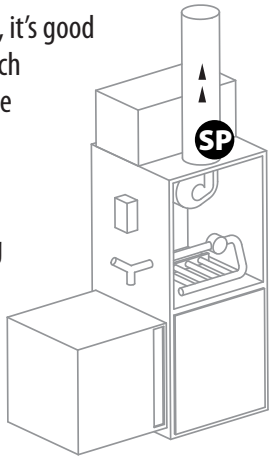
- Dispose of any condensate in the probe before storage.
- Ensure the probe has cooled to ambient temperature before inserting into its protective sleeve of the carrying case.
- Insert the CAT85 body upside down into the padded pocket so the display is fully covered and the cable is free to move.
- Do not stack objects on top of the case.
- Warmup is extended if freezing temperatures are detected, but it's best to store at room temperature.
- Store in a dry environment.
- If you notice condensation forming in the filter cap, unscrew it allow it to dry in storage. Be sure not to lose the o-ring.

Common Sampling Points

The many types of combustion equipment vary in their design and therefore their ideal sampling points. However, there are commonalities that make for useful guidelines when analyzing performance.

Heed equipment manufacturer instructions above anything mentioned in this manual.

- Before inserting the probe in the flue, it's good practice to test for excessive soot which may lead to carbon buildup within the analyzer or overexpose sensors.
- Use the probe cone lock to hold the probe tightly in place at the sampling point. The probe is designed to function in any orientation.
- The center of the flue is often a good place to locate the sensing point of the probe, but locating at the highest point of CO is best.

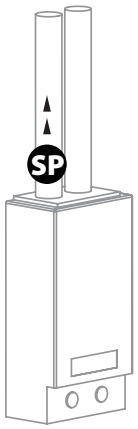


Power Burner
(Induced Draft) Furnace

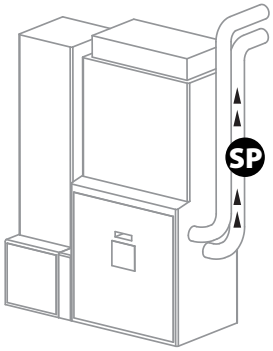
- After testing, consider using silicone or metal plugs to cover drilled holes. These are especially useful for double-walled flues.

SP Sample Point

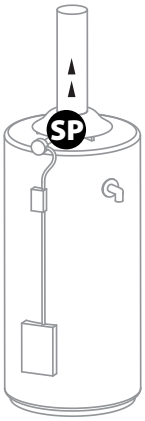
Flue Gas Direction



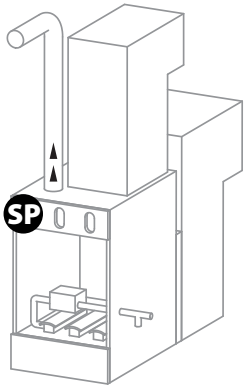
Power Burner
(Induced Draft)
Tankless Water Heater



High Efficiency
(Condensing) Furnace



Atmospheric
(Natural Draft)
Water Heater



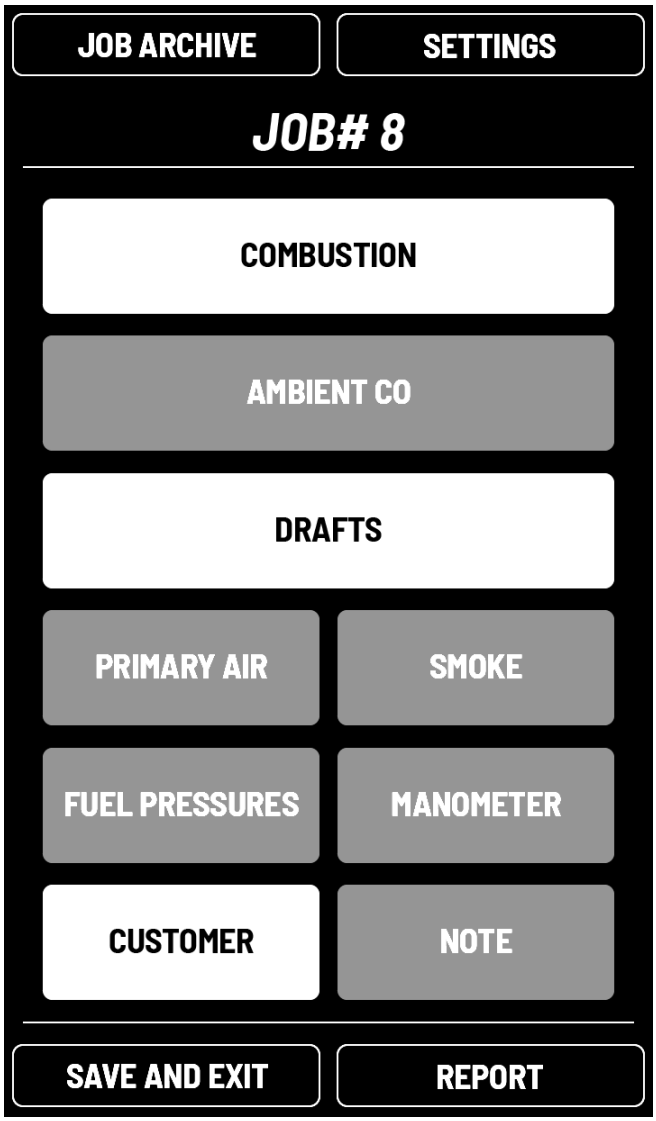
Atmospheric
(Natural Draft) Furnace

Job Menu

The JOB MENU is the central hub of CAT85. In addition to being the access point to SETTINGS and the JOB ARCHIVE, you can think of the JOB MENU as the form you complete for each job. Select a test, save the result, and go onto the next. Saved tests are highlighted, and you can always select a saved test to view, delete, or save over previous results.

Open the REPORT to send it to the Fieldpiece Wireless Thermal Printer (model CATPR). Alternatively, you can view live combustion and saved tests directly in the Job Link® mobile app.

When the job's done, select SAVE AND EXIT to store the job and automatically start a new one. Up to 1000 jobs can be stored and are sequentially numbered for easy tracking.



Combustion

By default, the COMBUSTION test starts automatically after startup is complete. This test analyzes flue gas from various heating equipment. Use this test to setup, test, and document equipment performance. You can view up to 8 parameters simultaneously which can be selected and positioned in SETTINGS. All 10 combustion parameters are saved and available for reporting.

CO Sensor Overexposure

Do not power off if you see this warning. It appears if the CO sensor detects a potentially damaging level of CO. Remove the probe from the flue so fresh ambient air can pump through the device.

Read "Safety Information" section.

1. Ensure startup is complete. *See "Powering On" section.*
2. Mount the CAT85 onto a secure, cool, magnetic surface near the sampling point.
3. Twist probe cone lock into the flue port at the sampling point and secure the probe. *See "Common Sampling Points" section.*
4. Select COMBUSTION from the JOB MENU.
5. Select the fuel and equipment type.
6. View live measurements.

- *For best results, test for at least 5 minutes where you find the highest level of CO - typically near the center of the flue.*

7. SAVE ALL measurements displayed.
8. Remove the probe and cone from the flue when finished.

- *Be careful not to let the metal touch anything until it cools.*
- *If you notice condensation forming in the filter cap, unscrew it and allow it to dry in storage. Be sure not to lose the o-ring.*

ZERO PROBE

ZERO PROBE sets the pressure sensor to 0 and resets the oxygen zero point. Always remove the probe from the flue before using ZERO PROBE. For the very best O2 measurements, start the pump and keep the probe in ambient air for 2 minutes before using ZERO PROBE. You should see a reading of approximately 20.9% O2 in ambient air.

Reference Ranges

If assigned to one of the top 4 measurement slots, the position of Stack Temperature, O2, CO, and CO at Reference O2 within its generally accepted range is shown for supported equipment. Supported equipment is indicated by an icon during selection. A GREEN arrow suggests an acceptable level. The arrow and reading are YELLOW if outside the range. *These ranges are for reference only.*

Trending

Use trending to check how combustion parameters change over time. *See "Settings" section for TRENDING SETUP.*

Gas Sensor Insights

- If O2 is reading normally, but CO is reading extremely low, the equipment may be burning very clean. Check the manufacturer's specification or test on known equipment to verify.
- If CO is reading normally, but O2 reads 0%, the O2 sensor may be clogged and needs to be replaced.
- If O2 is reading normally, but CO is reading higher than expected, the CO sensor may have been exposed to high CO concentration and needs to recover. *See "Powering On" section.*
- If O2 is not reading 20.9% in clean, ambient air, the sensor may have been sealed for a very long time. *See "Powering On" section.*

Ambient CO

CO is a very dangerous gas and it's critical that living spaces are clear of carbon monoxide.

Read "Safety Information" section.

1. Ensure startup is complete. *See "Powering On" section.*
2. Select AMBIENT CO from the JOB MENU.
3. View CO measurement while walking through the living space.
4. SAVE the measurement displayed.
   "DELETE" temporarily deletes a single value so you can retest.
   "DELETE TEST" deletes the test.

Ambient CO Warning

Vacate the area immediatly if you see the Ambient CO warning. It appears if the CO sensor detects a harmful level of CO. The CO warning level can be adjusted from the warning screen.

Drafts

CAT85 saves live draft pressure with the COMBUSTION test, but a saved FLUE DRAFT measurement overrides this value. Draft pressure measurement is important for safety and performance. The probe pressure sensor is used for all three drafts.

Read "Safety Information" section.

1. Ensure startup is complete. *See "Powering On" section.*
2. Select DRAFTS from the JOB MENU.
3. Mount the CAT85 onto a secure, cool, magnetic surface near the sampling point.
4. ZERO PROBE to zero the probe's pressure sensor.
   Always remove the probe from the flue before using ZERO PROBE.
5. Move probe to desired sampling point- DILUTED, FLUE, or OVERFIRE.
6. View live measurement.
7. SAVE the measurement displayed.
   "DELETE" temporarily deletes a single value so you can retest.
   "DELETE TEST" deletes the test.
8. Remove the probe from the sampling point when finished.
   Be careful not to let the metal touch anything until it cools.

Primary Air

Primary air temperature is measured during startup and is used for the COMBUSTION test. This is the temperature of the air going into the combustion equipment. It's sometimes useful to set it after startup if the ambient temperature changes. You can enter it manually or use the probe's temperature sensor.

Read "Safety Information" section.

1. Ensure startup is complete. *See "Powering On" section.*
2. Select PRIMARY AIR from the JOB MENU.
3. Move the probe to the entry point of air into the combustion equipment.
4. View live measurement or use the keyboard onscreen to manually enter a value.
5. SAVE the temperature.
   "DELETE" temporarily deletes a single value so you can retest.
   "DELETE TEST" deletes the test.

Smoke

The smoke test is used to document the soot levels within the flue. This is good practice when "dirty" combustion is expected in order to extend the life of CAT85 and equipment. A third party smoke tester is needed.

Read "Safety Information" section.

1. Ensure startup is complete. *See "Powering On" section.*
2. Select SMOKE from the JOB MENU.
3. Use your smoke tester to find the smoke level.
4. Select the corresponding level on screen.
5. SAVE the smoke level.
   "DELETE" deletes the entry.

Fuel Pressures

CAT85 has P1 and P2 pressure ports for testing gaseous fuel sources/regulators using the included hoses and brass fittings. Do not test liquid fuels. This is very similar to the Manometer test, but uses fuel-centric labels that aid in reporting.

Read "Safety Information" section.

1. Ensure startup is complete. *See "Powering On" section.*
2. Shut off main gas supply power to equipment.
3. Mount the CAT85 onto a secure, cool, magnetic surface near the test point(s).
4. Connect manometer hose to P1 to measure INLET pressure.
   Connect manometer hose to P2 to measure OUTLET pressure.
   An additional OUTLET pressure is available for two stage systems.
5. Select FUEL PRESSURES from the JOB MENU.
6. ZERO each pressure port sensor, P1 and P2, before connecting to fuel source. *Ensure there are no kinks in the hose.*
7. Connect hose(s) to INLET and/or OUTLET.
8. View live measurements.
9. SAVE any measurement displayed.
   "DELETE" temporarily deletes a single value so you can retest.
   "DELETE TEST" deletes the test.
10. Follow manufacturer's specification for target inlet and outlet fuel pressures before operating equipment.

Manometer

The manometer test uses P1 and P2 ports for easy static pressure testing. Save P1-P2 simultaneously or separately.

Read "Safety Information" section.

1. Ensure startup is complete. *See "Powering On" section.*
2. Mount the CAT85 onto a secure, cool, magnetic surface near the test point(s).
3. Connect manometer hose to P1. Connect manometer hose to P2.
4. Select MANOMETER from the JOB MENU.
5. ZERO each pressure port sensor, P1 and P2, before locating at test point. *Ensure there are no kinks in the hose.*
6. Point the hose openings towards the source of airflow. *Use model ASP2 static pressure probes for better control.*
7. View live measurements.
8. SAVE any measurement displayed.
   For measurements less than 2 inWC, save reading within 1 minute after zeroing for best accuracy.
   "DELETE" temporarily deletes a single value so you can retest.
   "DELETE TEST" deletes the test.

Customer

Each job has a customer entry. JOB ARCHIVE uses this entry for searching. You can use this field for whatever you want. For example, it can be a serial number or a phone number. See "Settings" section for report contents.

1. Ensure startup is complete. *See "Powering On" section.*
2. Select CUSTOMER from the JOB MENU.
3. Use the keyboard to enter.
4. SAVE the customer.
   "DELETE" deletes the entry.

Note

Each job has a note entry.

1. Ensure startup is complete. *See "Powering On" section.*
2. Select NOTE from the JOB MENU.
3. Use the keyboard to enter.
4. SAVE the note.
   "DELETE" deletes the entry.

Report

Each job has a report which is a collection of saved tests, your company info, reference O2, date, and time. Date and time is recorded at the time of sending the report. Edit report contents from SETTINGS.

1. Ensure startup is complete. *See "Powering On" section.*
2. Select REPORT from the JOB MENU.
   At least one test must be saved to view the job report.
   Saved jobs are opened from JOB ARCHIVE.
3. Scroll through the report using the scroll bar.
4. PRINT to model CATPR wireless thermal printer (optional).
   SEARCHING button changes to PRINT button if CATPR is detected.
5. DELETE JOB deletes the job from memory.

Job Link® System Reporting

Turn Job Link System ON to view CAT85 in the Job Link system mobile app (see "Settings" section). Communication is one-way, from the analyzer to the app. View live combustion and all saved tests of the current job directly in the app. Then, email a report directly from your mobile device.

Save and Exit

SAVE AND EXIT to save your job and start a new job, sequentially numbered. You can return to saved jobs from JOB ARCHIVE.

Low Memory Notice

A notice appears when memory is too low to SAVE AND EXIT. Delete jobs individually from JOB ARCHIVE or delete all jobs from SETTINGS.

Job Archive

Open JOB ARCHIVE from the JOB MENU.

- Sort jobs by date.
- Search jobs by customer.
- Select a job to open it.
- Use the X icon to delete a job.

Settings

Access SETTINGS from the top right corner of the Job Menu. Each setting button cycles through its options or to its own screen (blue arrow).

The DEFAULTS button in the top right corner of the settings reverts to default settings, but jobs are not deleted.

Job Link® System: OFF (default), ON
Select ON to view live combustion and saved tests on the Job Link system mobile app.

Brightness: HIGH, MEDIUM (default), LOW

Button Sound: ON (default), OFF

Sensor Remaining (status): % O2 and % CO sensor life remaining.
New sensors show approximately 100%. When life of either sensor is below 5%, a notice appears at startup.

Memory % Free (status): % of memory remaining for saving jobs.
Up to 1000 fully tested jobs can be saved. When memory is too low, a notice appears when trying to SAVE AND EXIT a job. DELETE ALL is a quick way to delete all jobs and restart at JOB #1. Delete single jobs from within the JOB ARCHIVE screen.

Date and Time: *EDIT to adjust date and time. 24-hour time is always used. Date format is always set to Year-Month-Day for easy sorting.*

Company Information: *EDIT to adjust Company Information shown on reports.*

Startup Screen: COMBUSTION (default), JOB MENU, FUEL TYPE
Set which screen you want to see after start countdown is complete.

Auto Hold Display: PUMP STOP (default), NEVER
Select NEVER to continue viewing live temperature and draft pressure while the pump is stopped.

Combustion Setup: *EDIT to select parameters and their slots on the COMBUSTION screen. To hide a slot completely, assign a parameter to the slot you want to hide, then assign that parameter to another slot.*

Trending Setup: *EDIT to select parameters on the TRENDING screen. SET LIMITS to adjust each parameter's UPPER (maximum) and LOWER (minimum) values of the graph. Controlling these limits allows you to effectively zoom and shift each parameter independently for better visibility.*

Report Contents: *EDIT to select what is shown on reports.*

Language (status): English (default). *This is not adjustable.*

Temperature Unit: ° F (default), °C

Pressure Unit: inWC (default), torr, Pa

[%] Reference O2: *EDIT to adjust the reference oxygen % used for calculating adjusted CO at Reference O2, CO (X%). For CO Air Free set to 0% O2.*

Efficiency Calculation: Standard (default), Siegert
Siegert's formula is typically only used in parts of Europe.

Firmware [version]: *UPDATE to install new firmware if it becomes*

Maintenance

General

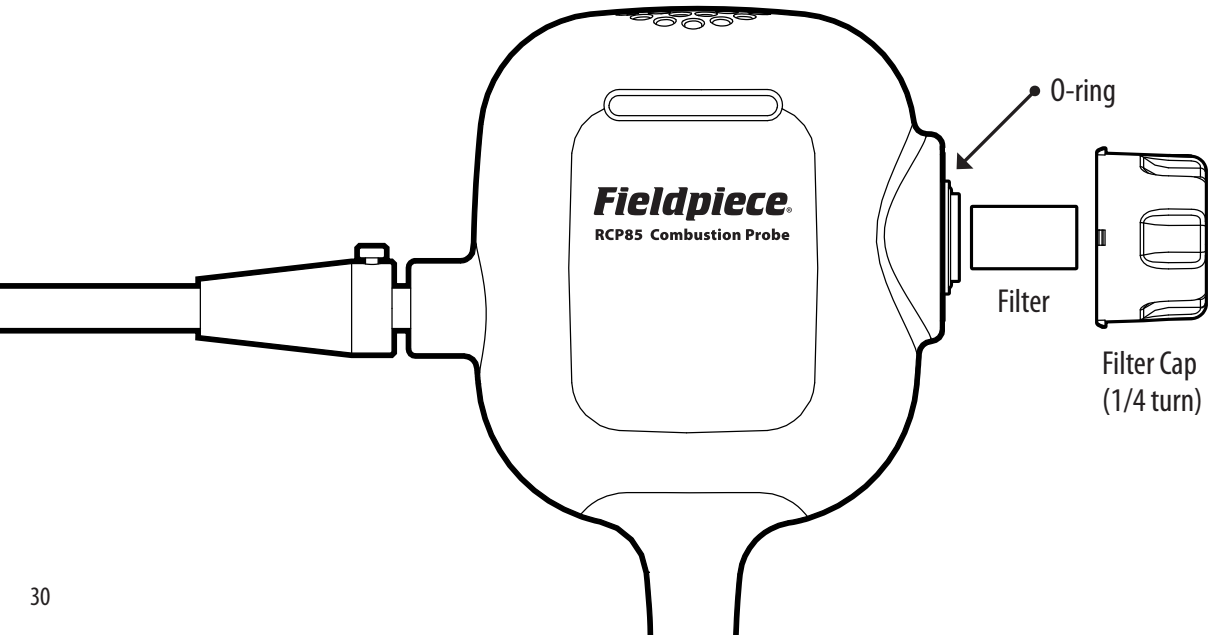
Wipe with damp cloth to clean the exterior.
Do not use solvents.

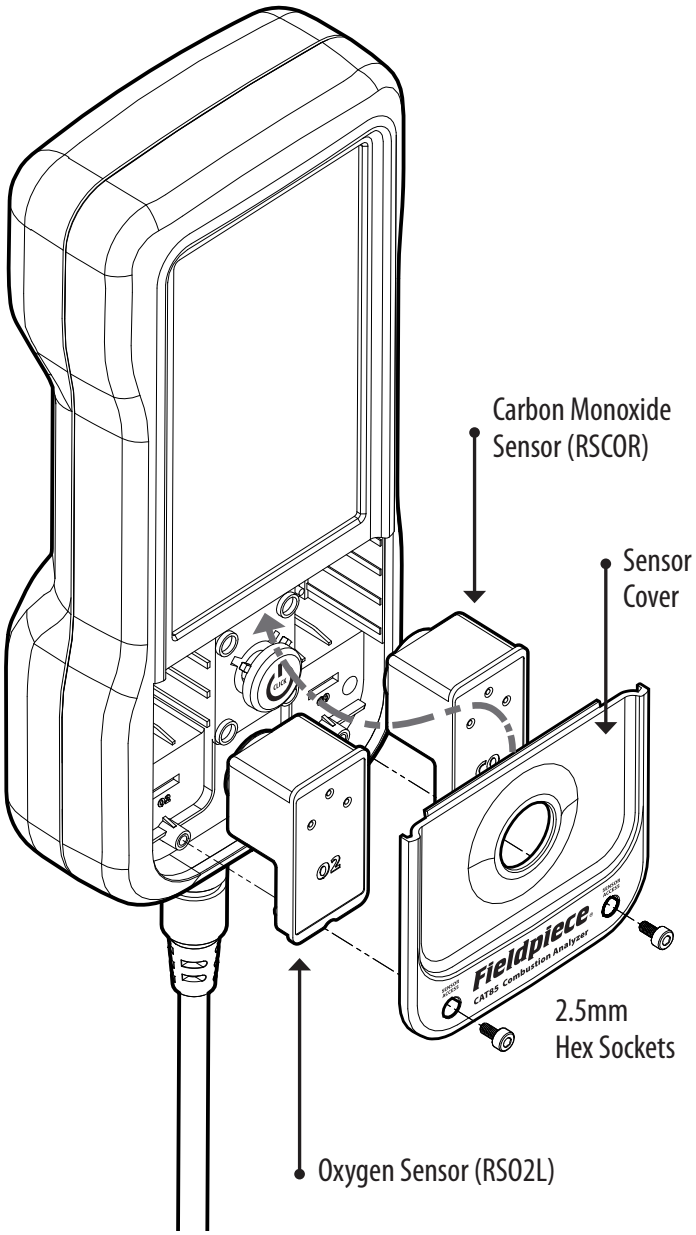
Dust Filter Replacement

Replace the dust (particulate) filter if you notice an increase in response times or when it's visually darker.

Dust Filters: model RFC10

1. Ensure the probe has cooled before opening to avoid contact with hot gas and liquid that may be within the probe.
2. Rotate the Filter Cap 1/4 turn counter-clockwise to release.
3. Pull out the old Probe Filter and replace if needed.
4. Pull out the O-ring and replace if needed.
5. Replace the Filter Cap.





Sensor Replacement

SensorVault™ technology prolongs the life of sensors, but they eventually need to be replaced. When a sensor's life drops below 5%, a notification appears during startup to inform you it's time to replace it. You can view estimated remaining life at any time in SETTINGS.

O2 sensor: model RSO2L
CO sensor: model RSCOR

1. Double check which sensor needs to be replaced.
   Leave a new sensor in its packaging until you're ready to install it.
2. Power off CAT85.
3. Use a 2.5mm hex key to remove the two socket head screws on the sensor cover labeled SENSOR ACCESS.
4. Lift up the bottom of the sensor cover to reveal the gas sensors.
5. Pull the old sensor straight out.
6. Check and remove the new sensor from its packaging.
7. Align and push the new sensor straight in.
   The sensor cover won't close if the sensor is inserted incorrectly.
8. Tilt the sensor cover lip back into place and fasten screws.
9. Power on CAT85 to check sensor life in SETTINGS.
   Anything above 95% is normal.

Calibration

Replacement sensors have air-tight packaging and are pre-calibrated. Annual re-calibration of existing sensors is recommended. Contact Fieldpiece for calibration service information.

Specifications

Display: Touchscreen TFT LCD (5.5 in diagonal)
Probe Size: 10.7 in (272 mm) length, 0.32 in (8.0 mm) diameter
Accuracy: Stated accuracies at 23°C ±5°C, <75% R.H.
Battery Type: 3.7 VDC (nominal), 6400mAh, non-replaceable
Battery Life: 5 hours typical (pump running 80% of the time)
Charging Port: USB-C (5V/2.0-2.4A DC)
(USB-A power adapter/charger not included)
(High speed chargers not supported)
Recharge Time: < 7 hours typical (Can be used while charging)
Memory: 1000 jobs (approx.)
Warm Up Time: 45 seconds (90 seconds near freezing)
Operating Environment:
14°F to 104°F (-10°C to 40°C); < 75% RH (non-condensing)
Storage Temperature: -4°F to 140°F (-20°C to 60°C); < 80% RH
Weight: 44.25 oz (1255 g) with probe
Wireless Range: 1000 feet (305 meters)
Fuel Types: Natural Gas, Propane (LPG), Oil #2 (Light), Oil #6 (Heavy), Biofuel, Coal, Coal Town Gas, Coking Oven Gas, KOKS, Custom (x3)
Warranty: 1 year (4 years sensors only)
Job Link® System Minimum:

BLE 4.0 devices running iOS 7.1 or Android™ Kitkat 4.4
Printer: Fieldpiece Wireless Thermal Printer (model CATPR)

Certifications:

FCC ID: 2ALHRCATX5

IC: Industry Canada
IC: 22518-CATX5

Waste Electrical and Electronic Equipment

Sensors

Temperature
Sensor Type: Type K rod thermocouple (fixed)
Response Time: < 30 seconds (T90)

Oxygen %
Sensor Type: Electrochemical (replaceable)
Response Time: < 30 seconds (T90)
Max Overload: 30% Oxygen

Carbon Monoxide PPM
Sensor Type: Electrochemical (replaceable)
Response Time: < 90 seconds (T90)
Max Overload: 10000 ppm Carbon Monoxide
Filter: NOx filter

Pressure (Probe)
Sensor Type: Piezoresistive pressure sensor
Response Time: < 10 seconds (T90)
Max Pressure: 4.0 inWC will cause damage
Units: inWC, torr, Pa

Pressure (Ports)
Sensor Type: Silicon pressure sensors
Response Time: < 10 seconds (T90)
Port Type: 2 connectors (P1, P2) for flex tubing (included) (4.5mm to 8.0mm ID)
Max Pressure: 11.6 psig (321 inWC) causes damage
Units: inWC, torr, Pa

Test Parameters

Stack Temperature
Range: 32 to 752°F; 0 to 400°C
Best resolution: 0.1°F; 0.1°C
Accuracy:
±2.5°F [32°F to 212°F], ±(3.6°F or 1.5%rdg) [213°F to 752°F];
±1.4°C [0°C to 100°C], ±(2.0°C or 1.5%rdg) [101°C to 400°C]

O2
Range: 0 to 21 vol.%
Best resolution: 0.1 vol.%
Accuracy: ±0.3 vol.%

CO
Range: 0 to 4000 ppm
Best resolution: 1 ppm
Accuracy: ±10 ppm [0 to 200 ppm], ±5%rdg [201 to 2000 ppm], ±10%rdg [2001 to 4000 ppm]

Live Draft Pressure
Range: 0 to ±0.8 inWC
Best resolution: 0.001 inWC
Accuracy: ±(0.01 inWC + 2%rdg)

CO at Reference O2, CO (X%) (Calculated)
CO (0%) refers to **CO Air Free**
Best resolution: 1 ppm

CO2 (Calculated)
Range: 0 to CO2max vol.%
Best resolution: 0.1 vol.%

Excess Air (Calculated)
Range: 0 to 999%
Best resolution: 0.1%

Efficiency (Calculated)
Range: 0 to 100%
Best resolution: 0.1%

qA (Calculated)
Range: 0 to 25%
Best resolution: 0.1%

Dew Point (Calculated)
Range: 32 to 212°F; 0 to 100°C
Best resolution: 0.1°F; 0.1°C

Primary Air Temp
Range: 32 to 212°F; 0 to 100°C
Best resolution: 0.1°F; 0.1°C
Accuracy: ±2.5°F [32°F to 212°F]; ±1.4°C [0°C to 100°C]

Ambient CO
Range: 0 to 200 ppm
Best resolution: 1 ppm
Accuracy: ±10 ppm

Manometer
Range: 0 to ±40 inWC
Best resolution: 0.01 inWC
Accuracy:
±0.2 inWC [0 to ±20 inWC], ±1%rdg [±(20.1 to 40.0 inWC)]

Fuel Pressures
Range: 0 to 40 inWC
Best resolution: 0.01 inWC
Accuracy:
±0.2 inWC [0 to 20 inWC], ±1%rdg [20.1 to 40.0 inWC]

Limited Warranty

This device is warranted against defects in material or workmanship for one year from date of purchase from an authorized Fieldpiece dealer.

The O2 and CO sensors are warranted against defects in material or workmanship for four years from date of purchase from an authorized Fieldpiece dealer.

Fieldpiece will replace or repair the defective unit, at its option, subject to verification of the defect.

This warranty does not apply to defects resulting from abuse, neglect, accident, unauthorized repair, alteration, or unreasonable use of the analyzer.

Any implied warranties arising from the sale of a Fieldpiece product, including but not limited to implied warranties of merchantability and fitness for a particular purpose, are limited to the above. Fieldpiece shall not be liable for loss of use of the analyzer or other incidental or consequential damages, expenses, or economic loss, or for any claim of such damage, expenses, or economic loss.

State laws vary. The above limitations or exclusions may not apply to you.

Obtaining Service

Warranty for products purchased outside of the U.S. should be handled through local distributors. Visit our website to find your local distributor.

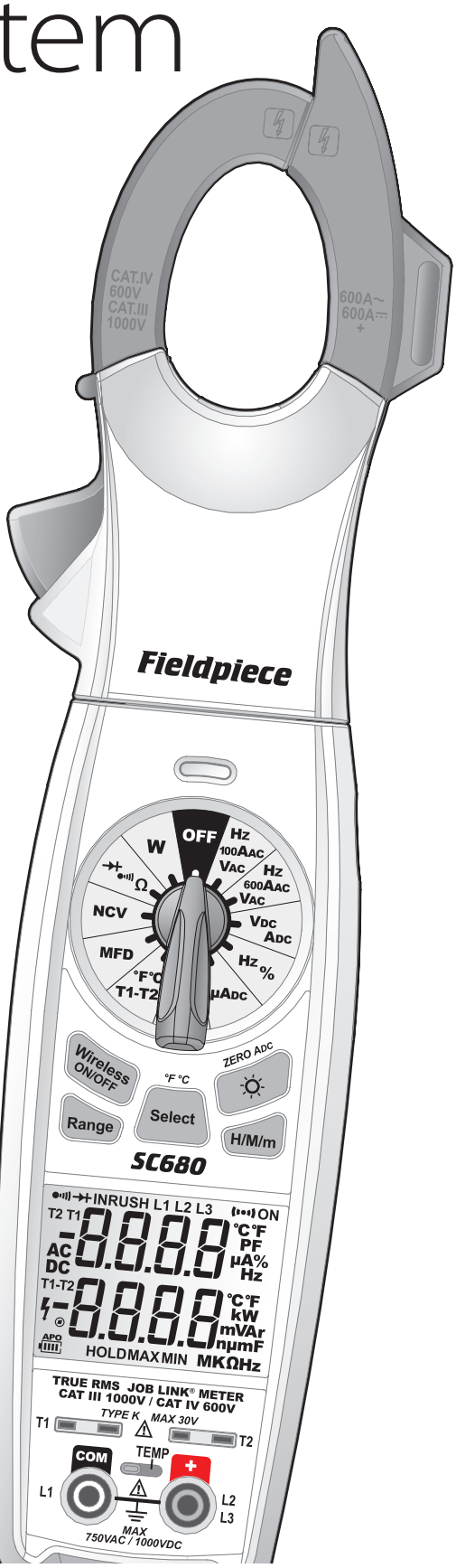
CAT85

Fieldpiece

Job Link® System Power Clamp Meter

OPERATOR'S MANUAL

Model SC680



Safety Information

Understand and follow operating instructions carefully.

A **Warning** identifies conditions and procedures that are dangerous to the user. A **Caution** identifies conditions and procedures that can cause damage to the Product or the equipment under test.

⚠ WARNING

To avoid possible electric shock, personal injury or death, follow these guidelines:

- Use the meter only as specified in this manual; otherwise, the protection provided by the meter may be impaired.
- Do not use if meter appears damaged. Visually inspect the meter to ensure case is not cracked and back case is securely in place.
- Inspect and replace leads if insulation is damaged, metal is exposed, or probes are cracked. Pay particular attention to the insulation surrounding the connectors.
- Do not use meter if it operates abnormally as protection maybe impaired.
- Use only correct measurement category (CAT), voltage, and amperage rated probes, test leads, and adapters for the measurement.
- Do not use this meter to verify the presence of hazardous voltages on circuits that may have voltages generated from frequencies above 1000Hz as the low pass filter limits voltage measurements to below 1000Hz.

- Do not use during electrical storms or in wet weather.
- Do not use around explosive gas, dust, or vapor.
- Do not apply more than the rated voltage to, as marked on the meter, between terminals or between any terminal and earth ground.
- Do not use without the battery and the back case properly installed.
- Replace battery as soon as battery indicator appears to avoid false readings.
- Remove the test leads from the circuit prior to removing battery cover.
- Do not attempt to repair this unit as it has no user-serviceable parts.
- Temperature switch prevents leaving thermocouple plugged in while measuring voltage.
- Do not measure current while the test leads are in the input jacks.
- When measuring high frequency AC current, do not exceed the rated 600AAC of the clamp. Failure to adhere may cause the clamp to heat up dangerously.
- Do not use the HOLD function to measure unknown potentials. When HOLD is turned on, the display does not change when a different potential is measured.
- Do not use in CAT III or CAT IV environments without the protective cap of test probe. The protective cap decreases the exposed probe metal <4mm. This decreases the possibility of arc

flash from short circuits.
- Do not place magnet inside Category IV panel. Place it outside the panel instead.

⚠ CAUTION

To protect yourself, think "Safety First":

- Voltages exceeding 30VAC or 60VDC pose a shock hazard so use caution.
- Use appropriate personal protective equipment such as safety glasses, face shields, insulating gloves, insulating boots, and/or insulating mats.
- Disconnect circuit power and discharge all high-voltage capacitors before testing resistance, continuity, diodes, or capacitance.

Before each use:

- Perform a continuity test by touching the test leads together to verify the functionality of the battery and test leads.
- Use the 3 Point Safety Method. (1) Verify meter operation by measuring a known voltage. (2) Apply meter to circuit under test. (3) Return to the known live voltage again to ensure proper operation.
- Use the proper terminals, functions and range for your measurements.
- Never ground yourself when taking electrical measurements.
- Connect the black common lead to ground or neutral before applying the red test lead to potential voltage. Disconnect the red test lead from the voltage first.

- Always work with a partner.
- Keep fingers behind the finger guards on the probes.

All voltage tests: All voltage ranges will withstand up to 1000VDC/750VAC rms. Do not apply more than 1000VDC or 750VAC rms.

Symbols used:

- Caution, risk of electric shock
- ⚠ Caution, refer to manual.
- ⏚ Ground
- ⧈ Double insulation

⚠ WARNINGS

DISCONNECT AND UNPLUG TEST LEADS before opening case.
TEST NCV FUNCTION ON KNOWN LIVE WIRE before using.
DO NOT APPLY VOLTAGE greater than 30VAC/VDC to the thermocouple or the jacks when the rotary dial is on °F°C. (Use only Type K thermocouples)
DO NOT APPLY VOLTAGE TO THE JACKS when the rotary dial is on microamps. Even low voltages can cause a current overload and potentially harm the meter.

Description

Your SC680 is the top of the line clamp meter with wireless functionality for the HVACR professional. Send your electrical measurements directly to the Job Link® System mobile app. Leave the meter behind a closed blower door and view the current measurement on your mobile device.

Help determine system efficiency by directly measuring power consumption (W) of the system. Use this value to inform your customer of energy saving measures you can take to help them save money on their energy bills.

The SC680 is the only meter you'll need for troubleshooting mini-split systems. Dual Type K temperature ports to measure entering/exiting air temperatures and measure frequency (Hz) directly with clamp jaw. Reach those cramped mini-split connectors with the included RCT2 probe tips for voltage and resistance measurements.

Hang your SC680 clamp meter to any metallic surface with the heavy-duty magnet. When the job is done, store your test leads in the back case for tidy and convenient storage. See both voltage and amperage readings at the same time on the large dual display.

Easily see your amperage readings no matter how you clamp around a wire with the swivel head AAC clamp.

Verify the order of 3-phase voltage lines with just two leads. Capture L1-L2 and L1-L3 to check that motor lines are correctly installed with Phase Rotation test.

Take more accurate VAC and AAC readings on variable frequency drives with True RMS sensing technology. Measure the starting amp draw of a compressor with Inrush current mode.

Illuminate the way with a powerful LED built into the clamp jaw. Easily see your measurements with the bright blue backlight on the display. Safely change functions with the backlit illuminated dial.

Take measurements more safely with one hand using the single test lead holder. Test leads come with removable gold plated tips to reliably connect Fieldpiece accessory heads.

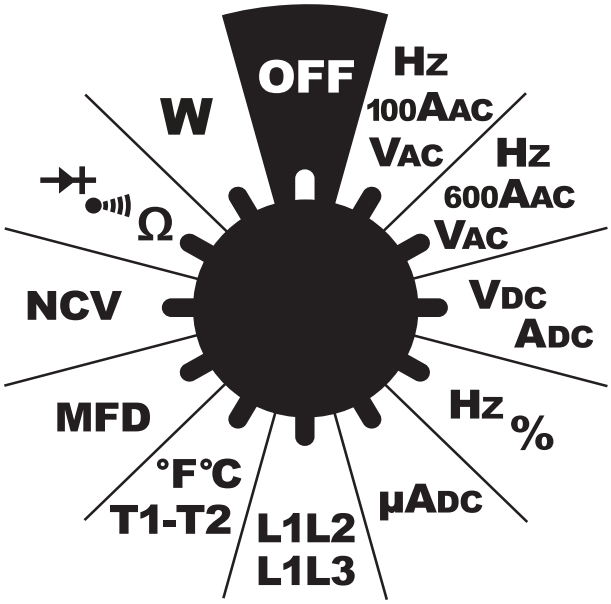
What's Included

- SC680 Job Link® System Power Clamp Meter
- ADLS2 Deluxe Test Leads Kit
- ASA2 Alligator Clips
- RCT2 Molex Probe Tips
- 2 ATB1 Type K Thermocouples
- 2 Velcro Straps
- 9V Alkaline Battery (Not installed)
- ANC7 Protective Padded Case
- Operator's manual

Quick Start

1. For electrical testing, connect test leads to black "COM" and red "+" jacks.
2. Rotate the dial to your desired measurement.
3. Connect to test points and read measurement.
4. For temperature testing, remove test leads, slide TEMP switch to the right and connect Type K thermocouples.

Measurements Dial



The SC680 is loaded with the measurement parameters essential for HVACR professionals. Select the parameter on the dial you want to measure with the rotating selector switch.

Buttons

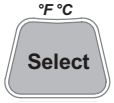
Illuminate backlight.
(Press for 1 second to zero Amps DC.)

Activate Inrush AAC capture mode.

Activate wireless to send measurements to Job Link® system mobile app.
Wait 3 seconds before switching positions to save setting.

Activate and cycle through Hold, Maximum, minimum, and real-time measurements.
(Press for 1 second to clear and exit)

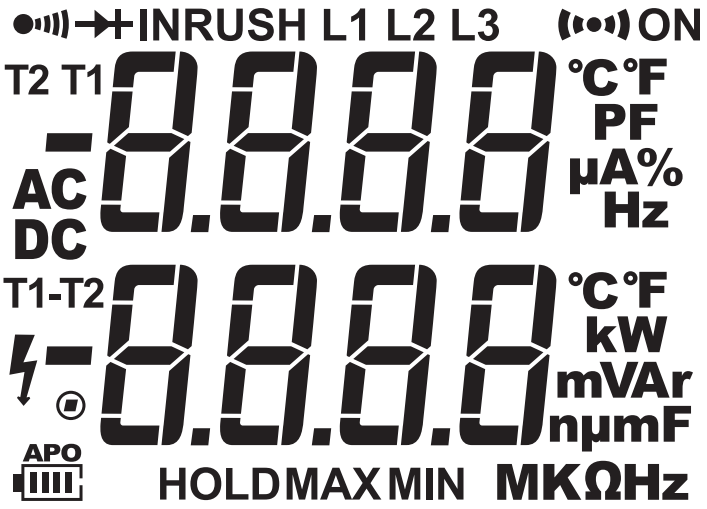
Deactivate autoranging and select the range manually.



Cycle through displayed values on applicable switch positions.
(Press for 1 second to toggle °F and °C)
(Hold while switching on to toggle high voltage warning beeper.)

Display Icons

	Battery Life Monitor
APO	Auto Power Off Enabled
	High Voltage Warning (>30VAC/VDC)
	Manual Ranging
HOLD	Data Hold
MAX	Maximum
MIN	Minimum
INRUSH	Inrush AAC
ON	Wireless ON to Job Link® mobile app
W	Watts (Active Power)
PF	Power Factor
VAr	Reactive Power
VA	Apparent Power
T1 T2	Temperature Inputs
T1-T2	Delta T
°F °C	Fahrenheit / Celsius
	Continuity Test
	Diode Test
Hz	Frequency (Hertz)
%	Duty Cycle (percentage)
Ω	Resistance Test (Ohms)
F	Capacitance Test (farads)
µA	Microamps DC
n	Nano Unit (10^{-9}, one billionth)
µ	Micro Unit (10^{-6}, one millionth)
m	Milli Unit (10^{-3}, one thousandth)
K	Kilo Unit (10^{3}, one thousand)
M	Mega Unit (10^{6}, one million)
AC	Alternating Current
DC	Direct Current



Easy to Read Display

Easily see your measurements on the large dual display. You'll never miss a reading no matter the lighting with the bright blue backlight to illuminate the way.

Measurement Dial

Volts AC (VAC) True RMS (50-400Hz)

Test power lines (120 to 480VAC), test 24VAC going to controls and test for transformer failure.

Ranges: 1000mV, 10V, 100V, 750V **Resolution:** 0.1mV
Accuracy: ±(1.5% + 10) 50Hz to 60Hz
±(2.0% + 10) 60Hz to 400Hz
Unspecified at 400Hz and greater
Minimum Input Voltage Range: >20 digits
Low Pass Filter: >1 kHz
Crest Factor: ≤ 3
Audio/Visual Hi-V Indicator: >30VAC/VDC
Input Impedance: 5MΩ
Overload Protection: 1000VDC or 750VAC rms

Volts DC (VDC)

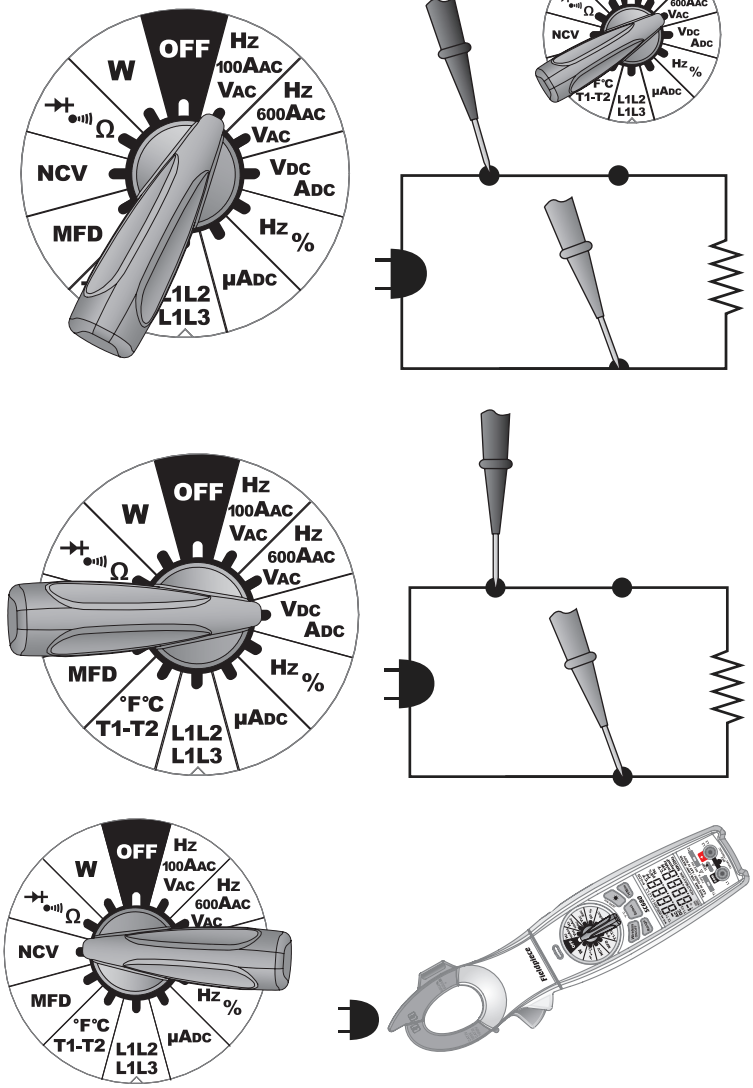
Select VDC and measure DC voltages on circuit boards on more advanced HVACR systems and logic control boards. In VDC/ADC dial position, VDC is shown on lower display. Press SELECT button to show ADC on the top display at the same time.

Ranges: 1000mV, 10V, 100V, 1000V **Resolution:** 0.1mV
Accuracy: ±(0.5% + 5)
Input Impedance: 5MΩ
Overload Protection: 1000VDC or 750VAC rms

Non Contact Voltage (NCV)

Use NCV to check 24VAC from a thermostat or live voltage up to 600VAC. Always test a known live source before using. A segment graph and RED LED will display the presence of voltage. An audible beep increases from intermittent to continuous as intensity of field (EF) increases.

AC Voltage Detection Range: 24VAC to 600VAC (50-60Hz)



Amps AC (AAC) True RMS (50-60Hz)

Test isolated power lines. Press SELECT on VAC/100AAC/Hz or VAC/600AAC/Hz position. Read AAC in upper display and VAC on the lower display. For AC current <100AAC, select VAC/100AAC/Hz switch position and for AC current >100AAC, select the VAC/600AAC/Hz switch position.

Range: 100A, 600A **Resolution:** 0.01A **Crest factor:** ≤ 3
Accuracy: ±(2.5% + 15) 100A, ±(2.0% + 10) 600A
Minimum Input Current Range: >20 digits
Overload Protection: 600AAC **Jaw Opening:** 1.2in (30 mm)

Frequency (Hz) Through Clamp

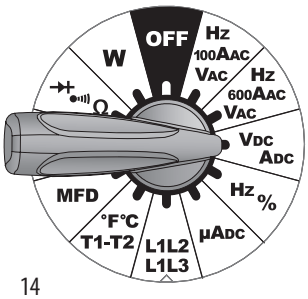
Measure Hz on variable frequency drive motors. Turn dial to either VAC/100AAC/Hz or VAC/600AAC/Hz position and press SELECT twice. Hz will show in upper display and VAC on the lower display at the same time.

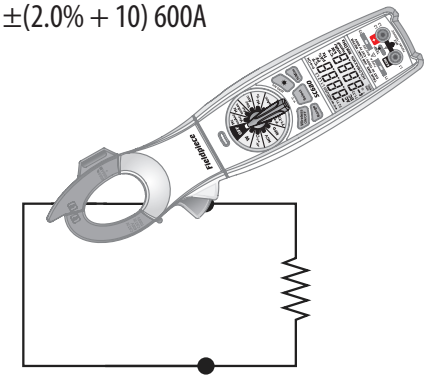
Range: 10Hz to 400Hz **Resolution:** 0.1Hz
Accuracy: ±(0.1% + 5)
Minimum current range: >7AAC (10 to 100Hz); >20AAC (100 to 400Hz) on 100AAC range; >25AAC (10 to 400Hz) on 600AAC range.
Overload Protection: 600AAC

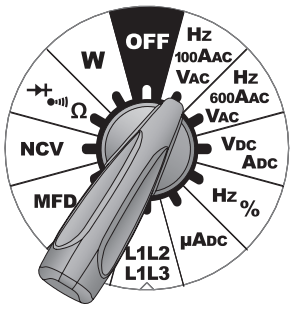
Amps DC (ADC)

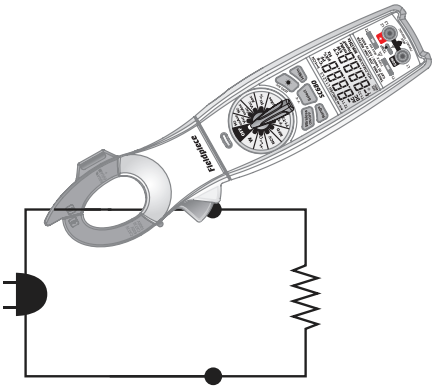
Measure ADC through the clamp jaw. Press  for 1 second to zero the ADC value in the top display.

Ranges: 100A, 600A **Resolution:** 0.01A **Jaw Opening:** 1.2in (30 mm)
Accuracy: ±(2.5% + 15) 100A, ±(2.0% + 10) 600A
Overload Protection: 600ADC









Amps AC (AAC), Frequency (Hz) through the clamp and Inrush AAC current is measured in the VAC/100AAC/Hz or VAC/600AAC/Hz switch position shown above.

Inrush AAC Current

Inrush mode captures the starting amp draw of a motor. Starting amp draw can assist in diagnosing a motor before it fails.

Activate Inrush mode

1 Rotate selector switch to VAC/100AAC/Hz or VAC/600AAC/Hz
2 Press SELECT once to show AAC on upper display. Press INRUSH on the right side of meter to activate Inrush Mode.
3 Clamp jaw around the motor's start wire.
4 Turn motor on. The starting amp draw will hold on the upper display.
5 Press INRUSH to clear captured reading. Press INRUSH for 2 seconds to exit.

Inrush measurement period: 100-milliseconds
Minimum input: >2A on 100AAC range; >20A on 600A range

⚠ Note: AAC or Hz through the clamp and VAC through the test leads can be measured simultaneously. However, if only AAC, Frequency (Hz), or Inrush AAC is measured through the clamp, test leads and thermocouples must be unplugged from the meter.

MicroAmps DC (µADC)

Test flame rectifier diodes on a heater control. Connect leads between flame sensor probe and control module. Turn heating unit on. When the flame is on, there should be a measurable µADC signal, typically under 10µADC. Compare measurement to manufacturer's specification to determine if replacement is necessary.

Ranges: 1000µA **Resolution:** 0.1µA
Accuracy: ±(1.0% + 5) **Volts burden:** 5V
Overload Protection: 600VDC or 600VAC rms

Frequency (Hz) Through Leads

Check incoming voltages to ensure they are cycling at 60Hz. For frequency measurements on VFD equipment, use the amp clamp.

Ranges: 100Hz, 1000Hz, 10kHz, 100kHz, 1000kHz **Resolution:** 0.01Hz
Accuracy: ±(0.1% + 5) **Sensitivity:** 10Hz to 1000kHz: >3.5Vrms
Minimum PW: >1µs **Duty Cycle Limits:** >30% and <70%
Overload Protection: 600VDC or 600VAC rms

Duty Cycle (%)

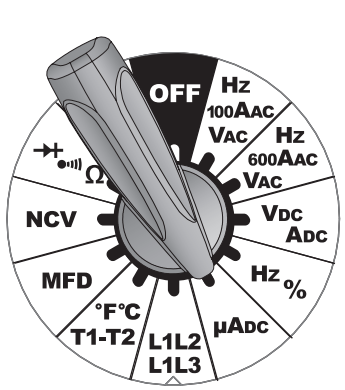
Duty cycle shows the % On Time of a 5V logic signal square wave.

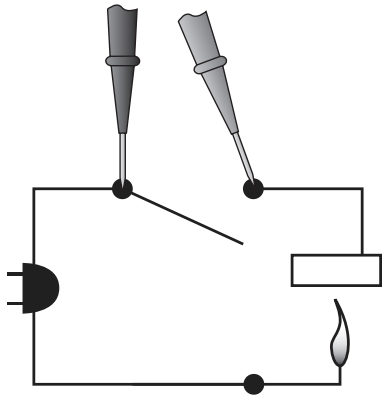
Ranges: 5%-95% (40Hz to 1kHz), 10%-90% (1kHz to 10kHz), 20%-80% (10kHz to 20kHz)
Accuracy (5V logic): ±(2% + 10) **Resolution:** 0.1%
Pulse Width: >10µs
Overload Protection: 600VDC or 600VAC rms

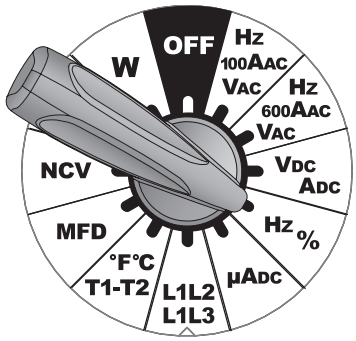
Capacitance (MFD)

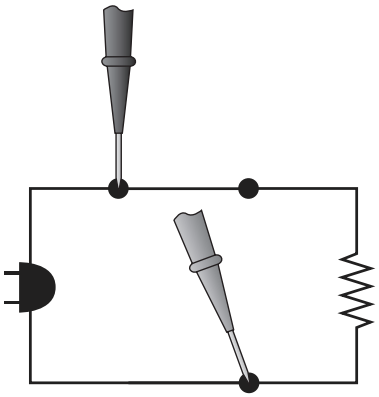
Test motor start and run capacitors. Capacitors are one of the most failure prone components in a HVACR system. Disconnect from power and any resistors found between terminals. Discharge capacitor before testing. If dIS.C is displayed, the capacitor needs to be fully discharged to test.

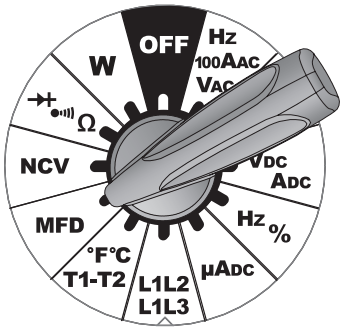
Ranges: 10nF, 100nF, 1000nF, 10µF, 100µF, 1000µF, 10mF
Accuracy: ±(3% + 15) 10nF, ±(3% + 5) 100nF to 1000µF, ±(5% + 5) 10mF
Resolution: 0.01nF **Overload Protection:** 600VDC or 600VAC rms

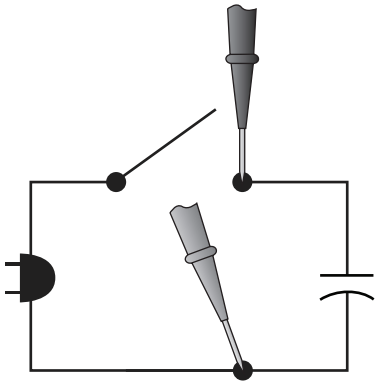










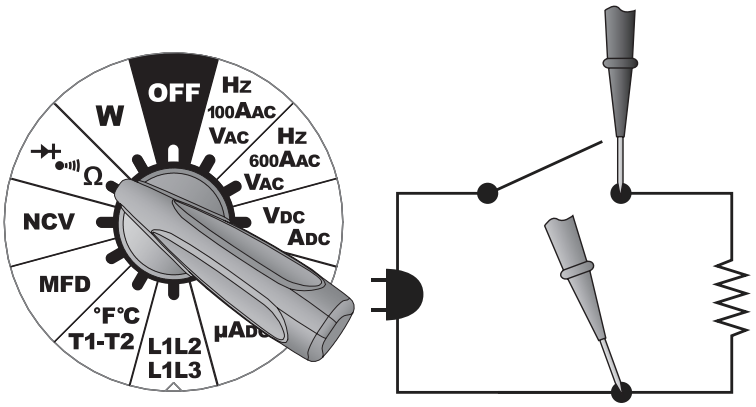


Discharge Cap First!

Resistance (Ω)

Used for "ohming out" a compressor. A 0.01Ω resolution is useful to test the resistance between the terminal poles because the values are typically very low. For best practice, use a megger (Fieldpiece SMG5) to measure motor winding insultion to ground.

Ranges: 100Ω, 1000Ω, 10kΩ, 100kΩ, 1000kΩ, 10MΩ, 50MΩ
Resolution: 0.01Ω
Accuracy: ±(1.0% + 15) 100Ω, ±(1.0% + 5) 1000Ω to 100kΩ, ±(1.5% + 5) 1000kΩ, ±(3.0% + 5) 10MΩ to 50MΩ
Open circuit volts: -1.1VDC typical, -3.2VDC (100Ω range)
Overload Protection: 600VDC or 600VAC rms



Continuity (•)))

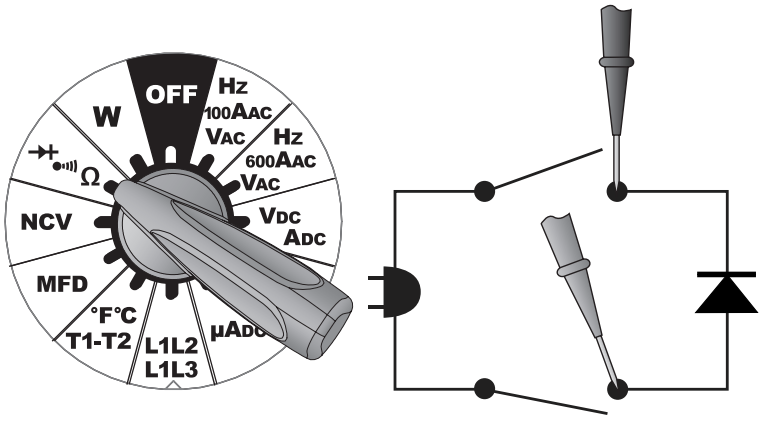
Perfect for checking isolated fuses, use the continuity function to test whether a circuit is open (no beep, no green LED) or closed (beep and green LED). Press SELECT once to enter Continuity mode.

Range: 100Ω **Resolution:** 0.01Ω **Response time:** 100ms
Audible beep: <30Ω
Visual Indicator: Green LED
Overload Protection: 600VDC or 600VAC rms

Diode Test (→|)

Test diodes for proper forward and reversed-biased functions. A voltage will display in forward-bias and "OL" in reversed-bias. Press SELECT twice to enter Diode mode.

Test current: 0.8mA (Approx.) **Accuracy:** ±(1.5% + 5)
Open circuit volts: 3.2VDC typical **Audible beep**: <0.05V
Visual Indicator: Green LED
Overload Protection: 600VDC or 600VAC rms



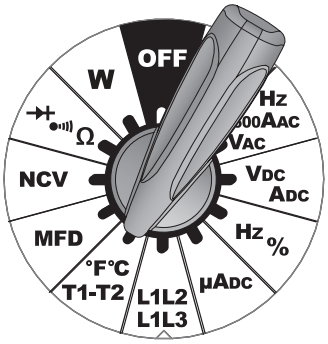
Dual Temperature (T1, T2, T1-T2)

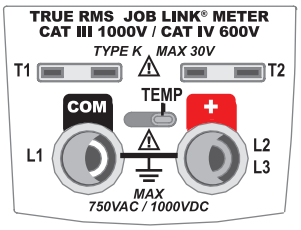
Plug any Type K thermocouple directly into the meter to measure temperature. The meter beeps when a thermocouple is plugged in and double beeps when unplugged. Test for proper airflow across the evaporator coil by measuring delta T with the dual temperature inputs.

Insulated cold junction is located inside the meter and allows for accurate measurements even in rapidly changing ambient temperatures (going from rooftop to freezer). No adapter is required.

By default, T1 will show on top display and T2 on bottom display. Press SELECT button once to display T1 on top and T1-T2 on the bottom. Press SELECT button again to display T2 on top and T1-T2 on the bottom.

Range: -58°F to 2372°F, (-50°C to 1300°C) **Resolution:** 0.1°
Accuracy: ±(1°F)* 32°F to 120°F, ±(1°C) 0°C to 49°C
±(1%+2°F) 32°F to 932°F, ±(1%+1°C) 0°C to 500°C
±(2%+6°F) -58°F to 32°F, ±(2%+3°C) -50°C to 0°C
±(2%+6°F) 932°F to 2372°F, ±(2%+3°C) 500°C to 1300°C
Sensor type: Type K thermocouple *After field calibration
Overload protection: 30 VDC or 30VAC rms





Unplug Leads and Slide TEMP Switch to the Right

Change Units (°F or °C)

By default, temperature units are set to Fahrenheit (°F). In Temperature dial position, press SELECT button for 1 second to toggle between Fahrenheit (°F) and Celsius (°C).

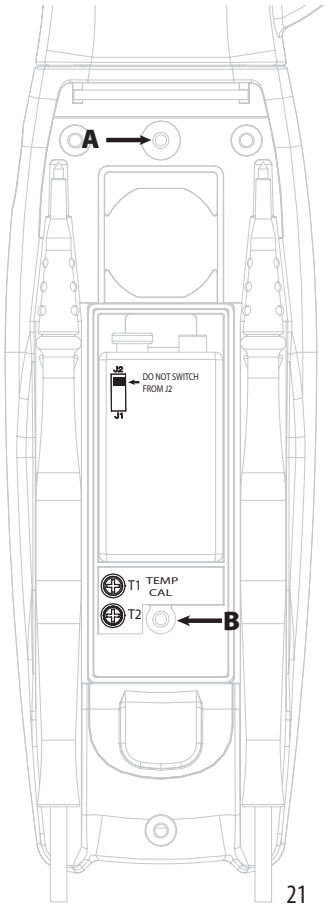
Temperature Calibration

Thermocouples (T/C) are not calibrated directly. Instead, each T/C jack (T1 and T2) must be calibrated to the particular T/C that is plugged into it. Though it's possible for a calibration to hold for years, it's best practice to calibrate regularly if only to verify accuracy. Labelling your T/C, T1 or T2, will help ensure using the same T/C for T1 and T2 ports.

Calibration is quick and easy, requiring just a known temperature to calibrate to. Ice water is probably the most accurate and readily available known temperature (32.0°F, 0.0°C) in the field.

1. Rotate dial to the °F °C, T1-T2 position.
2. Plug one thermocouple to be calibrated into the T1 Type K jack.
3. Unscrew A and B and remove the battery cover.
4. Stabilize a large cup of ice water. Stir the ice with the water until temperature stays at a stable value.
5. Immerse the T1 thermocouple probe and let it stabilize. Keep stirring water to prevent thermocouple from direct contact with ice.
6. Use a small screwdriver to adjust calibration T1 Temp Cal pot below the battery as close to 32°F(0°C) as you would like.
7. Repeat step 2-6 and replace T2 for T1 for T2 thermocouple.

Note: J1-J2 switch is for factory calibration purposes only. Do not switch from J2.



Power (Watts, VAr, VA, WDC, PF)

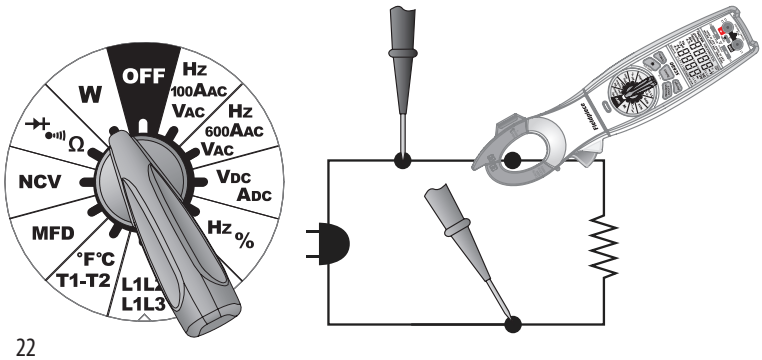
Help determine system efficiency by measuring the power exerted by the system. The actual power consumed by the system is called Active Power and is measured in watts (W or kW). Reactive loads, inductors and capacitors, dissipate zero power, but they drop voltage and draw current giving the deceptive impression they do dissipate power. This is called Reactive Power and is measured in Volt-Amps-Reactive (VAr). The combination of reactive and real power is called Apparent Power and is the product of a system's voltage and current, without phase angle consideration. Apparent Power is measured in Volt-Amps (VA).

Power Factor (PF) is the ratio of the power the system draws from the main power supply and the power the system actually consumes. An ideal PF is 1, meaning the system consumes all the power it draws. Due to inductive and capacitive loads of the system however, this is not possible.

To take the power reading you need to measure both voltage and amperage simultaneously. Connect test leads to main power supply terminals and secure amp clamp around the same line that the positive (red) test lead is connected to.

See Power Factor in top display and Power in bottom display. Press SELECT to toggle Active Power (W), Reactive Power (VAr), Apparent Power (VA) and DC Power (W).

⚠ CAUTION! DO NOT MEASURE VOLTAGE LINES OR EXPOSE THE METER TO LIVE POWER LINES EXCEEDING 750VAC/1000VDC NOMINAL VOLTAGE.



Power (Watts, VAr, VA, WDC, PF)

Accuracy: Stated accuracy @ 73°F±9°F (23°C±5°C), <75%RH
Effective Current Range: 2AAC/ADC to 600AAC/ADC
Effective Voltage Range: 80VAC to 750VAC, 80VDC to 1000VDC
Effective Frequency Response: 50Hz to 60Hz
Power accuracies unspecified for non-sinusoidal current waveforms

Active Power (W)
Ranges: 1000W, 10kW, 100kW, 450kW
Resolution: 0.1W
Accuracy: ±(5.0% + 5) >10A
±(10.0% + 5) 2A to 10A on 450kW range

Reactive Power (VAr)
Ranges: 1000VAr, 10kVAr, 100kVAr, 450kVAr
Resolution: 0.1VAr
Accuracy: ±(5.0% + 5) >10A on 1000VAr range
±(10.0% + 5) 2A to 10A

Apparent Power (VA)
Ranges: 1000VA, 10kVA, 100kVA, 450kVA
Resolution: 0.1VA
Accuracy: ±(5% + 5) >2A

DC Power (W)
Ranges: 1000W, 10kW, 100kW, 600kW
Resolution: 0.1W
Accuracy: ±(5% + 5) > 10A, ±(10.0% + 5) 2A to 10A

Power Factor (PF)
Ranges: -1.00 to -0.30 and 0.30 to 1.00
Resolution: 0.01 PF
Accuracy: ±(5.0% + 5) >10A, ±(10.0% + 5) 2A to 10A
PF readings will be displayed on upper display

Phase Rotation Test (L1L2, L1L3)

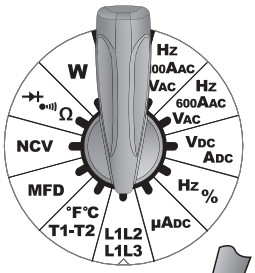
Connect 3-phase power lines in the correct order to the terminals of a motor to ensure the motor turns in the intended direction. Incorrect wiring can damage some equipment. The terminals on the motor are usually marked L1, L2, and L3; however, the wires supplying power usually are not. Perform a simple phase rotation test with two test leads to quickly identify the order of 3-phase power lines.

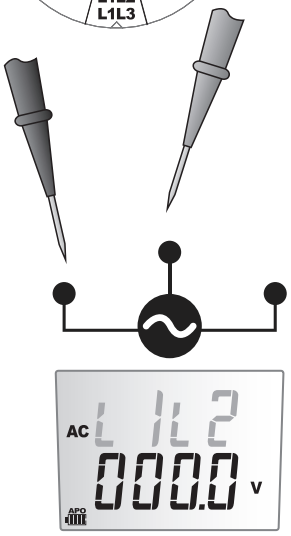
Range: 80±5 VAC to 600VAC (50Hz to 80Hz) **Resolution:** 0.1V
Accuracy: ±(1.5% rdg + 10 dgts)
Overload Protection: 600VDC or AC rms

How to Perform a Phase Rotation Test

Set 1: Select Function

Switch to L1L2 L1L3. Plug black test lead into the COM (L1) port and red test lead to the VΩ (L2 L3) port on the SC680.

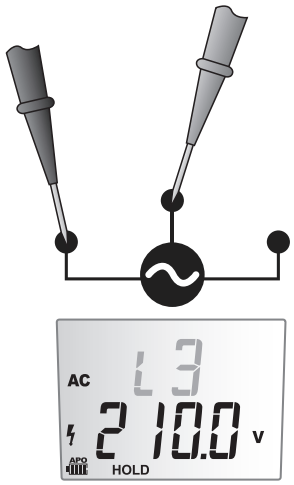




You will see "L1L2" blinking to indicate phase rotation test is ready to begin.

Step 2: Connect Leads

Connect both black and red test leads to any two of the three phase voltage lines in question. The line voltage will hold on the bottom display. Blinking L1 and L2 disappear. L3 will blink on top display to indicate test is ready for Step 2.

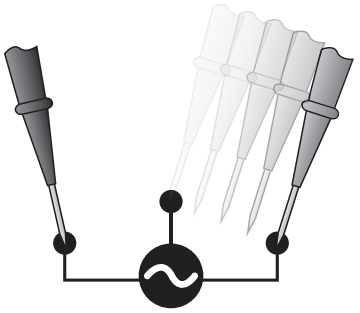


Important: Step 2 must be performed within 5 seconds of completing Step 1 or "Err" will show and Step 1 must be repeated.

Step 3: Move Red Lead

With the black lead still on "L1", move the red test lead to the third 3-phase voltage line. The line voltage will hold on the bottom display. The top display will show L123 indicating forward or L321 indicating reversed.

Simply swap any two lines to change the direction. You can verify this by performing the test again.



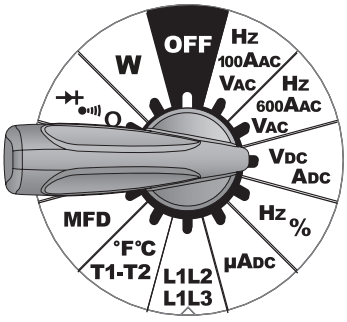
Phase Rotation Testing Tips

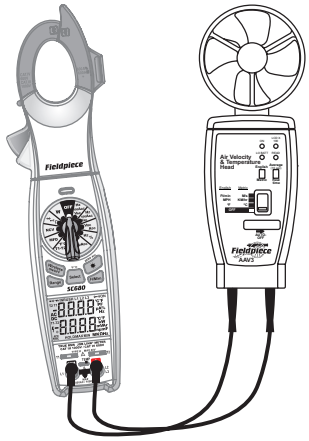
1 The measured voltage during phase rotation test must be >80.0±5VAC. If not, the phase rotation test can not be performed and "Err" will show on the top display.
2 After phase rotation test is complete, press SELECT button to begin a new phase rotation test.
3 Be sure to connect test leads to 3-phase voltage lines for at least 2 seconds until voltage reading holds on the bottom display
4 Phase rotation test cannot be performed on Hi-frequency voltage signals. Be sure voltage lines are within 50-80Hz to perform the phase rotation test.

Modular Expandability

Your SC680 is compatible with Fieldpiece Accessory Heads. With Fieldpiece Accessory Heads, you can measure any available parameter, and read the measurement on your new meter's display in real-time, Hold, Max, and min.

Rotate the selector to VDC and stay in mV range. Remove the probe tips of your test leads, and connect your accessory head (model AAV3 shown).





Works with Job Link® System

Do More with the Job Link® System

Directly document critical electrical measurements at the job site, and add them to professional PDF reports. No separate transmitter required.

Combine your new clamp meter with other Job Link System tools to create seamless reports. Show customers what needs to be done (Pre-work) and prove how that work helped (Post-work).

Other Job Link® System Tools

- SM480V Refrigerant Manifold + Micron Gauge (4 Port)
- SM380V Refrigerant Manifold + Micron Gauge (3 Port)
- JL3KH6 Wireless Charge and Air Test Kit
- JL3KR4 Wireless Charge Test Kit
- SRS3 Wireless Refrigerant Scale

Wireless Mode

Send electrical measurements wirelessly from SC680 directly to the Job Link® mobile app. No JL2 transmitter required.

1 Select any switch position other than L1L2 and NCV.
2 Press WIRELESS ON/OFF to toggle wireless mode. *To maximize battery life, wireless mode is OFF by default. To save WIRELESS ON/OFF setting, allow 3 seconds before switching positions.*
3 Assign your meter in the Job Link app tool manager.
4 Tap on the Electrical tab in the Job Link measurement screen and begin logging measurements from your clamp meter.

Wireless Specifications

Wireless range: Up to 1000 feet (305m) line of sight. Distance decreases through obstructions.
Wireless frequency: 2.4 GHz

Wireless Compatibility

Minimum Device Requirement:
BLE 4.0 devices running iOS® 7.0 or Android™ 5.0

Functions

Auto Power Off

Auto power off or APO will automatically turn off your meter after 30 minutes of inactivty. By default it is activated and APO will show on the display. To disable, turn meter off. Hold Range and power on the meter by turning the selector dial to any range. Release Range after the beep. APO will no longer display over the battery icon.

Hold/Max/min

Press H/M/m to cycle through Hold, Maximum, minimum, or real-time measurements. When MAXMIN is displayed, you are seeing the real-time measurement, but Max and min values are still being recorded. Press H/M/m for 1 second to clear and exit. Press H/M/m to log an SC680 measurement in Job Link mobile app. See Wireless Section for Job Link compatibility details.

High Voltage Warning

The ϟ symbol will display when measuring >30VAC/VDC. An audible beep will be heard and red LED will be shown. *To toggle the high voltage beeper, hold SELECT when turning on. "Beep On" or "Beep Off" is shown on the display when toggled.*

Battery Replacement

When your meter's battery is low, the battery icon will appear empty and blink for 30 seconds. "bAtt" will display and meter will power off.

Turn dial to OFF position, disconnect test leads and remove the battery cover with magnet strap on the back of your meter. Remove old battery and replace with a standard 9V battery only. Be sure to re-insert the magnet strap before re-installing the battery cover.

Backlight Illumination

See your measurements in dark environments. Press ZERO Adc to illuminate the display and the selector dial. Illumination will stay on for 5 minutes before turning off automatically. Illumination can be turned off at any time by pressing ZERO Adc.

Manual Ranging

Press Range to disable auto-ranging and set your clamp meter to a specific range. Manual ranging applies to VAC, VDC, Hz, MFD, W and resistance (Ω). Press for 1 second to exit manual ranging and return to auto-ranging.

Certifications and Module IDs

UL 61010-1, Third Edition

EN61010-1, EN61010-2-032
EN61010-2-033, EMC EN61326-1

FCC ID: 2ALHR008

RCM (N22675)

WEEE

Restriction of Hazardous Substances Compliant

IC: Industry Canada
22518-BT008

IFETEL: Federal Telecom Institute
RCPFI2A19-0287

CATIV 600V, CATIII 1000V or above. Included test leads are gold-plated and have removable safety caps.
CATIII 1000V, CATIV 600 class II and pollution degree 2 indoor use comply with CE, RoHS compliant.
CATIII is designated for measurements performed in the building installation.
CATIV is for measurements performed at the source of the low-voltage installation.

Specifications

Display: 10000 count dual display
Backlight: 5 minute duration with auto-off, blue color
Overrange: "OL" or "-OL" is displayed
Measurement rate: 3.3 times per second, nominal
Zero: Automatic
Operating environment: 32°F to 122°F (0°C to 50°C) at <70%RH
Storage temperature: -4°F to 140°F (-20°C to 60°C), 0 to 80%RH (with battery removed)
Accuracy: Stated accuracy @ 73°F±9°F (23°C±5°C), <75%RH
Temperature coefficient: 0.1 x (specified accuracy) per °C [0°C to 19°C (32°F to 66°F), 28°C to 50° C (82°F to 122°F)]
APO (Auto Power Off): Approx. 30 minutes
Power: Single standard 9-volt battery, NEDA 1604, JIS 006P, IEC 6F22
Battery life: 100 hours typical alkaline (No wireless, no backlight)
Low battery indication: Battery icon blinks and "batt" is displayed when the battery voltage drops below the operating level
Dimensions: 301.5mm(H) x 79.5mm(W) x 50.0mm(D)
Weight: Approx. 480g including battery
Altitude: Up to 6562 ft (2000m)
Overload protection: 1000VDC or 750VAC rms unless otherwise stated
Test leads: Use UL listed test leads that comply to UL61010-031 rated CATIV 600V, CATIII 1000V or above. Included test leads are gold-plated and have removable safety caps.

Please operate the instrument following all instructions of the operator's manual to avoid impairing the safety of the product.

FCC Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

1. Reorient the receiving antenna.
2. Increase the separation between the equipment and receiver.
3. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
4. Consult the dealer or an experienced radio/TV technician for help.

FCC Caution:

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

IMPORTANT NOTE: FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

IC Statement

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1. L'appareil ne doit pas produire de brouillage;
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

IMPORTANT NOTE: IC Radiation Exposure Statement:

This equipment complies with IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20cm de distance entre la source de rayonnement et votre corps

IFETEL Statement

La operación de este equipo está sujeta a las siguientes dos condiciones: (1) es posible que este equipo o dispositivo no cause interferencia perjudicial y (2) este equipo o dispositivo debe aceptar cualquier interferencia, incluyendo la que pueda causar su operación no deseada.

The operation of this equipment is subject to the following two conditions: (1) this device or device may not cause harmful interference, and (2) this device or device must accept any interference, including interference that may cause undesired operation.

Limited Warranty

This product is warranted against defects in material or workmanship for one year from date of purchase from an authorized Fieldpiece dealer. Fieldpiece will replace or repair the defective unit, at its option, subject to verification of the defect.

This warranty does not apply to defects resulting from abuse, neglect, accident, unauthorized repair, alteration, or unreasonable use of the machine.

Any implied warranties arising from the sale of a Fieldpiece product, including but not limited to implied warranties of merchantability and fitness for a particular purpose, are limited to the above. Fieldpiece shall not be liable for loss of use of the machine or other incidental or consequential damages, expenses, or economic loss, or for any claim of such damage, expenses, or economic loss.

State laws vary. The above limitations or exclusions may not apply to you.

Warranty for products purchased outside of the U.S. should be handled through local distributors. Visit our website to find your local distributor.

SC680

Fieldpiece

Dual Port Manometer and Pressure Switch Tester

OPERATOR'S MANUAL

Model
SDMN6

01

Quick Start

1. Press for 1 second to turn on your SDMN6.
2. If necessary, press ZERO for 1 second to set the ambient pressure of P1 and P2.
3. P1 will be displayed in inches of water column (inWC.) P1-P2 will be displayed on lower line.
4. See sections below for details on testing pressure switches.

Scan for Video

Certifications

C-Tick (N22675)

CE

WEEE

RoHS Compliant

02

Description

Correct pressure switch operation is integral to the safety of a furnace environment.

The SDMN6 is a dual-port manometer that also accurately tests pressure switches by simulating a draft with an internal pump.

Adjust the pump's speed to create a negative pressure (vacuum). The red LED indicates when the switch closes. View the closing/opening pressures directly on the LCD.

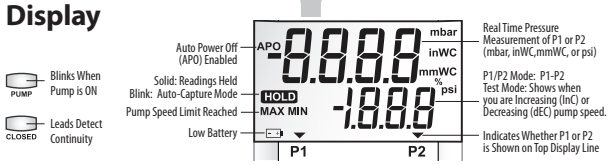
The dual-port manometer measures ±60 inches of water column, high enough for gas pressures.

Check building pressurization with static pressure resolution of 0.01"WC. View P1-P2 in the bottom line of the display for checking pressure differentials.

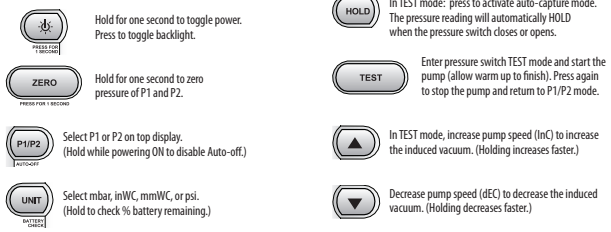
Use the static pressure probes to check for a pressure drop accross two points in a duct. This is useful for evaluating a blower or finding airflow restrictions in the ductwork.

03

Display



Controls



04 05

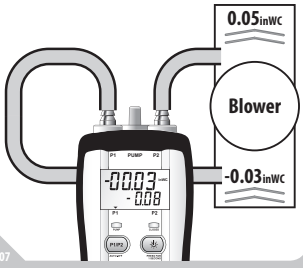
Specifications

Operating environment: 32°F to 118°F (0°C to 48°C) at <80% RH
Storage temperature: -4°F to 140°F (-20°C to 60°C), 0 to 80% RH (with battery removed)
Power: 9V, NEDA 1604A, IEC 6LR61 9V alkaline battery.
Battery life (alkaline): 200 hours (manometer only, backlight off), 12 hours (pressure switch testing @ 27% pump speed, BL off, approx -2.5"WC induced pressure w/o pump bleed accessory)
Auto power off (APO): 15 minutes
Low battery indication:
Units of Measure: inWC, mmWC, mbar, psi
Resolution: 0.01 inWC
Overrange: "OL" or "-OL" is displayed
Max Pressure: 900inWC (17.4psi) will damage sensors
Compatible media: Dry, non-corrosive gases
Pressure ports: 2 connectors (P1, P2) for flexible tubing (4.5mm to 8mm ID)
Pump port: 1 connector (PUMP) for 5mm (~3/16 inch) ID flexible tubing
Lead jacks: 2 banana plug jacks for testing open/close switch status (continuity between terminals)
Accuracy: Stated accuracy at 0 to 50°C (32 to 122°F): ±1.5% FS
Accuracy and ranges:
inWC: ±0.02 on 0.00 to ±2.00 (±1.5% FS on 2.00 to ±60.0);
mmWC: ±0.5 on 0.00 to ±51.0 (±1.5% FS on 51.0 to ±1500);
mbar: ±0.05 on 0.00 to ±5.00 (±1.5% FS on 5.00 to ±150.0);
psi: ±0.001 on 0.000 to ±0.07 (±1.5% FS on 0.07 to ±2.000)

06

Static Pressure

1. ZERO your SDMN6 while at ambient pressure with any hoses/probes attached. This will zero both P1 and P2. For measurements less than 2 inWC, take reading within 1 minute after zeroing for best accuracy.
2. Use one hose (P1 or P2) to get the gauge pressure relative to the ambient or ZERO pressure.
3. Connect both hoses if you want to see relative pressure, P1 - P2. This is common when evaluating equipment such as a blower.



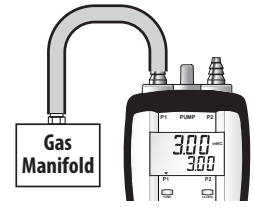
07

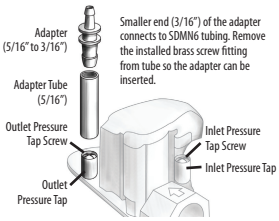
NOTE: Always use the static pressure probes if checking static pressure of an airflow stream.
NOTE: The red arrows on the probes should point toward the airflow stream.

4. You can press P1 / P2 to toggle the top display between P1 and P2. Note: P1 - P2 is shown in the bottom line of the LCD.
5. Press UNITS to select: inches of water column (inWC), millimeters of water column (mmWC), millibar (mBar), or pounds per square inch (psi).
6. Your SDMN6 will turn off automatically after 15 minutes of inactivity if APO is shown. To disable auto-power-off (APO) hold P1/P2 while turning on your SDMN6.
7. If you are in an environment where the temperature is noticeably changing while you are taking your reading, it is advised that you disconnect the meter from the hoses and ZERO it relative to ambient before each reading.

08

Gas Pressure





09

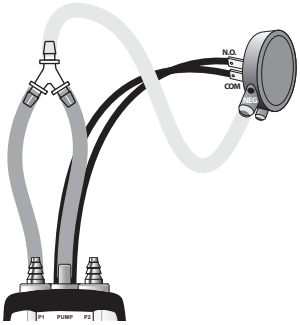
1. See manufacturer's specification for target inlet and outlet pressures.
2. Shut off main gas supply to furnace.
3. Shut off power to furnace equipment.
4. Zero your SDMN6 while at ambient pressure with hoses attached.
5. Remove outlet pressure tap screw, and insert the brass screw fitting of the P1 hose into the outlet pressure tap of the gas regulator.

NOTE: Some pressure taps have a 5/16" boss instead of an insert screw. In this case, remove the brass screw fitting from the P1 hose and connect the included 5/16" adapter tube. Loosen the tap screw about 1 revolution, and slide the tube over the boss (see illustration at left). Make sure the tube is over the boss enough to prevent leakage.

6. Put furnace into operation (i.e. turn on gas and power to the furnace, call for heating, and have furnace ignite as if running it in normal operation).
7. P1 will show the pressure coming out of the regulator.
8. If you suspect high or low inlet pressure into the regulator, connect P1 to inlet tap and P2 to outlet tap to see the pressure drop across the regulator.

10

Pressure Switch Test



WARNING: Read "Pressure Switch Testing Safety Info" section below prior to testing.

1. Connect leads (interchangeable) from the SDMN6 to the N.O. (normally open) and COM (common) terminals of the pressure switch.
2. Connect the 2 yellow hoses of the Y-splitter to the P1 and PUMP ports of your SDMN6.

3. ZERO your SDMN6 while at ambient pressure with yellow hoses attached. For measurements less than 2 inWC, take reading within 1 minute after zeroing for best accuracy.
4. Press TEST to start the pump. A brief warm up period ensues.
5. Now connect the white hose to the negative side of the pressure switch. ***(Incorrect setup will cause incorrect pressure measurements.)***
6. Make sure the pressure switch is vertically oriented, the same as it is on the equipment.
7. **If the CLOSED LED is OFF**, press ▲ to increase the pump speed and induce a negative pressure on the switch. The CLOSED LED will light when the pressure switch closes. Note the closing pressure.

   If the CLOSED LED is ON, press ▼ to slow the pump and decrease the negative pressure on the switch. The CLOSED LED turns off when the switch opens. Note the opening pressure.

NOTE: For higher rated switches, you can hold down ▲ or ▼ to accelerate/decelerate the pump faster. Slow your acceleration as you approach the switch's rated pressure.

NOTE: A pressure switch should open and close within the manufacturer's tolerance rating of the switch (typically ±10%).

AUTO CAPTURE MODE

Press HOLD to automatically HOLD a closing or opening pressure of a switch as you change the speed of the pump. "HOLD" blinks until a change in continuity is detected. Press HOLD again to exit AUTO CAPTURE mode.

PUMP BLEED ACCESSORY

Most pressure switches have a bleed port to help regulate the pressure required to close and open the switch.

Pressure switches rated around -0.10inWC often *don't* have a bleed port. You can insert the Pump Bleed Accessory directly onto the PUMP port to give the pump better control of these low negative pressures.

Indications a pressure switch is out of calibration, has a weak/bad diaphragm, or a bad micro switch in the pressure switch:

- Closing/opening outside the manufacturer's tolerance rating.
- CLOSED LED blinks rapidly.
- Dramatic fluctuations of pressure readings.

Checking the Diaphragm

If you have difficulty maintaining the correct pressure to open and close the switch the diaphragm could be cracked.

Checking the Bleed Port

Pressure readings are greatly affected when the hose to the pressure switch is pinched. If the pressure does not change when you pinch the hose on a pressure switch with a bleed port, the bleed port could be blocked.

Examine the bleed port for signs of corrosion or debris. Corrosion is a sign that the switch has been exposed to excessive moisture and diaphragm could be coated with debris.

Checking the Inducer

If the pressure created by the inducer measures more than enough to close the pressure switch, but the SDMN6 proves the pressure switch to be good, the inducer may not be providing enough airflow to close the switch.

Adjustable Pressure Switch Calibration

WARNING: Read "Pressure Switch Testing Safety Info" section below prior to testing.

1. Follow steps 1-6 of "Pressure Switch Test".
7. Press ▲ / ▼ to adjust the pump speed until displayed negative pressure is stable, within ±0.02 inWC of your target pressure.
8. Start with the switch closed. If the switch is open, slowly loosen the adjustment screw until the CLOSED LED turns on.
9. Open the switch by slowly tightening the adjustment screw on the adjustable pressure switch until the CLOSED LED turns off. The adjustable pressure switch is now calibrated to your target pressure.

NOTE: Stabilized pressures may slightly fluctuate after an adjustment. Be sure to adjust the pump speed (▲ / ▼) as needed to maintain the desired induced negative pressure.

NOTE: Dual-pressure switches only have one spring and one diaphragm so it's only necessary to test the negative side.

Transducer Test

1. Connect the 2 yellow hoses of the Y-splitter to the P1 and PUMP ports of your SDMN6.
2. Connect a volt meter to the transducer's terminals.
3. ZERO your SDMN6 while at ambient pressure with yellow hoses attached. For measurements less than 2 inWC, take reading within 1 minute after zeroing for best accuracy.
4. Press TEST to start the pump. A brief warm up period ensues.
5. Now connect the white hose to the low side of the transducer. ***(Incorrect setup will cause incorrect pressure measurements.)***
6. Press ▲ / ▼ to increase/decrease the pump speed and resulting negative pressure. For higher rated transducers, you can hold down the button to get the pump up to speed faster.
7. As you increase the negative pressure, the voltage across the terminals will change based on the transducer's rating. Compare observed voltage to rated voltage to determine the health of the transducer.

Pressure Switch Testing Safety Info

The pressure switch is a safety device that prevents the furnace from running in an unsafe condition. An unsafe condition can result in injury, loss of property or even loss of life.

1. Before every use, check the SDMN6 and the tubing for breaks or blockage. Check the tubing for any moisture as well.
2. It is critical that the hoses going to P1 and the switch are the same length.
3. Check for the presence of moisture in the pressure switch before using the SDMN6. Do not use the SDMN6 on a pressure switch that has moisture in it. Moisture can damage the SDMN6 and VOID the warranty. Check the tubing for moisture build-up as well.
4. The SDMN6 is designed to produce a precise amount of negative pressure. Always zero the SDMN6 before testing a switch.
5. Fieldpiece is not responsible for incorrect readings by faulty test equipment or untrained personnel.
6. In the interest of safety, the SDMN6 should only be used by trained, competent professionals who understand the hazards and

consider the risks of working on and with tools and equipment.

7. The pressure rating for the pressure switch is either stamped on the pressure switch or on a sticker attached to the pressure switch. Otherwise, contact the vendor or manufacturer of the furnace to get that information.
8. An adjustable pressure switch must open at the desired negative pressure to match the one it is replacing.
9. Fieldpiece is not liable for any damages, injuries, or loss of life incurred by the misuse of the SDMN6.

NOTE: Pressure switch ratings are noted by "[pressure] PF". This means that the circuit opens when the switch senses its rated Pressure Fall. Example: A -0.40" WC PF rated switch should open at a negative 0.40 inches of water column. The pressure switch should close and more importantly "open" within the manufacturer's tolerance rating.

⚠ WARNINGS ⚠

Turn off power to furnace prior to testing to avoid low voltage shorting.

Limited Warranty

This meter is warranted against defects in material or workmanship for one year from date of purchase. Fieldpiece will replace or repair the defective unit, at its option, subject to verification of the defect. This warranty does not apply to defects resulting from abuse, neglect, accident, unauthorized repair, alteration, or unreasonable use of the instrument.

Any implied warranties arising from the sale of a Fieldpiece product, including but not limited to implied warranties of merchantability and fitness for a particular purpose, are limited to the above. Fieldpiece shall not be liable for loss of use of the instrument or other incidental or consequential damages, expenses, or economic loss, or for any claim of such damage, expenses, or economic loss. State laws vary. The above limitations or exclusions may not apply to you.

For Service

In the USA, call Fieldpiece Instruments for one-price-fix-all out of warranty service pricing. Send check or money order for the amount quoted. Send the meter freight prepaid to Fieldpiece Instruments. Send proof of date and location of purchase for in-warranty service. The meter will be repaired or replaced, at the option of Fieldpiece, and returned via least cost transportation.

For international customers, warranty for products purchased outside of the U.S. should be handled through local distributors.

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